"A STUDY ON EVALUATION OF POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING LAPAROTOMY"

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CERTIFICATE

This is to certify that the dissertation entitled "**A STUDY ON EVALUATION OF POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING LAPAROTOMY**" is a bonafide original work of

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DECLARATION

I hereby solemnly declare that the dissertation titled "**A STUDY ON EVALUATION OF POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING LAPAROTOMY**" is done by me at Stanley Medical College & Govt. General Hospital, Chennai during 2014-15 under the guidance and supervision of Prof.Dr.A.K.RAJENDRAN, Prof.Dr.P.DARWIN, Prof.Dr.V.RUKMANGATHAN and my head of the department Prof Dr.S.VISWANATHAN. The dissertation is submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai towards the partial fulfillment of requirements for the award of M.S. Degree (Branch-I) in General Surgery.

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LIST OF ABBREVIATIONS

POSSUM	- -	Physiological and Operative Severity Score for enUmeration of Mortality and Morbidity
ASA	- -	American Society of Anesthiologists
JVP	- -	Jugular Venous Pulse
CVA	- -	Cerebrovascular Accident
GCS	- -	Glasgow Coma Scale
ECG	- -	Electrocardiogram
DVT	- -	Deep Venous Thrombosis
GFR	- -	Glomerular Filtration Rate
ARDS	- -	Acute Respiratory Distress Syndrome
MODS	- -	Multi Organ Dysfunction Syndrome
SIRS	- -	Systemic Inflammatory Response Syndrome
ABG	- -	Arterial Blood Gas Analysis
PE	- -	Pulmonary Embolism

CHAPTER 1

INTRODUCTION

1.INTRODUCTION

1.1 BACKGROUND

Risk management is an important health care issue. Prediction of complications is an essential part of risk management in surgery. Knowing which patient is at risk of developing complications contributes to the quality of surgical care and cost reduction in surgery. It is therefore essential to identify and make appropriate decision on those patients who are at high risk of developing serious complications.

Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity (POSSUM) has been used to produce numerical estimate of expected mortality and morbidity after variety of surgical procedures. It can be used in hospital setting to provide educational information. It integrates well in the existing hospital programs without causing any disruptions of hospital activities. When other scoring systems were compared with POSSUM, it was shown that POSSUM results were much more useful in predicting the outcome of surgery for patients. Comparison of various studies with POSSUM in various countries with different health systems and socio-economic status to that of the UK showed that there was no change in POSSUM ability to predict outcome of surgery. In this study, a dual scoring system of POSSUM was evaluated in Stanley medical college hospital, Chennai.

It was developed by Copeland et al in 1991 and has since been applied to a number of surgical groups including orthopaedic patients, vascular surgery (AAA, carotid endarterectomy etc), head and neck surgery and GI/Colorectal surgery. POSSUM is becoming more widely used in the UK as surgical culture moves more towards outcome measures and providing the patient with as much information as possible to make fully informed consent. Furthermore a system that uses risk adjusted prediction is going to become an essential tool for clinical governance reviews to 'prove' a units' performance and also for an individual consultant surgeons appraisal process for much the same reason.

POSSUM used exponential analysis and a report from Whiteley et al 1998 claimed that POSSUM over predicted death in their group of patients especially in low-risk patients. In an effort to counteract this effect the original POSSUM equation was modified leading to the Portsmouth predictor equation for mortality (P-POSSUM) utilising the same physiological and operative variables. This method used linear analysis. Further studies have since shown the use of POSSUM and P-POSSUM to predict mortality equally well. Even the P-POSSUM model still overpredicts mortality in low-risk groups, but is a better 'fit' than POSSUM.

There have been reports of overprediction in different surgical specialities. This has led some to produce specialty-specific POSSUM such as V-POSSUM for use in elective vascular surgery (Prytherch 2001)

1.2 OBJECTIVES

The Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity (POSSUM) is a patient risk prediction model based on 12 patient characteristics and 6 characteristics of the surgery performed.

The objective of the present study is to assess the accuracy of POSSUM in predicting mortality and morbidity in patients undergoing laparotomy in both elective and emergency settings

CHAPTER 2

REVIEW OF LITERATURE

REVIEW OF LITERATURE

2.1 SCORES IN GENERAL SURGERY

The modern preparation of a patient for surgery is epitomized by the convergence of the art and science of the surgical discipline. The risk assessment scores provide some basic algorithms that aid in the preparation of patients for surgery. The components of these scores take into account the perioperative and later postoperative period and hope to identify factors that account for patient morbidity and mortality during these periods.

(i) RISK ASSESSMENT SCORES IN PRE OPERATIVE EVALUATION

The aim of these scores is to uncover problem areas to be made amenable to preoperative optimization. This evaluation is driven by findings on the history and physical examination suggestive of organ system dysfunction or by epidemiological data suggesting the benefit of evaluation based on age, gender or patterns of disease progression.

ASA classification

The American Society of Anesthesiologists classification was one of the first risk categorization systems. It has five stratifications

I. Normal healthy patient.

II. Mild systemic disease.

III. Severe systemic disease that's limits activity but not incapacitating.

IV. Incapacitating disease that is a constant threat to life.

V. Moribund patient not expected to survive 24 hours.

The letter "E" is added to any of these for an emergency operation. Even though the system seems subjective, it continues to be a significant independent predictor of mortality.

APACHE II

Acute Physiology and And Chronic Health Evaluation captures the severity of the patient's *acute medical (pneumonia) or surgical (peritonitis)* conditions along with his *chronic health* and *age.* Its accuracy has been validated for a wide range of conditions, both in and out of critical care environment. It stratifies patients into three risk groups.

- Low (scores <10) where postoperative outcome is predicted to be excellent
- High (scores >20) denoting critical disease and hence poor outcome and complications

- Intermediate (scores 11-20) “anything can happen”

Cardiac risk indices

Numerous assessment tools for stratification of cardiovascular risk are available. The premiere index is the Goldman’s criteria of cardiac risk for non cardiac surgery. This strategy is designed by multivariate analysis, assigning points to easily reproducible characteristics.

This concept has been further refined in the Revised Cardiac Risk Index, which uses six predictors of complications.

Goldman Cardiac Risk Index, 1977

VARIABLES	POINTS	COMPLICATION RATE
Third heart sound / JVP	**11**	**0-5 = 1%**
Recent myocardial infarction	**10**	**6-12 = 7%**
Non sinus rhythm/ PMC on ECG	**7**	**13-25 = 14%**
>5 premature ventricular beats	**7**	**>26 = 78%**
Age >70 years	**5**	
Emergency operations	**4**	
Poor general condition	**3**	
Intrathoracic/ aortic surgery	**3**	
Valvular aortic stenosis	**3**	

Revised cardiac risk index

VARIABLES	POINTS	
Ischemic heart disease	*1*	*Each increment in point increases post operative myocardial morbidity*
Congestive cardiac failure	*1*	
Cerebral vascular disease	*1*	
High – risk surgery	*1*	
Preoperatively on insulin treatment for Diabetes mellitus	*1*	
Preoperative creatinine >2mg/dl	*1*	

Eagle's criteria for cardiac risk assessment, 1989

VARIABLES	POINTS	COMPLICATION RATE
Age >70 years	**1**	**<1 – no testing**
Diabetes	**1**	**1-2 – non invasive testing needed**
Angina	**1**	**>= 3 – angiography**
Q waves on ECG	**1**	
Ventricular arrythmias	**1**	

Pulmonary risk class assignment

Pre operative evaluation of pulmonary function may be necessary for thoracic or general surgical procedures. Necessary tests include forced expiratory volume in 1 second (FEV_1), forced vital capacity and diffusion capacity of carbon monoxide. Functional segments of lung are identified by quantitative lung scans.

General factors that increase risk for post operative pulmonary complications include

- Type of surgery – aortic and thoracic procedures
- Age of the patient > 60 years
- Dependent functional status
- Lower albumin level
- Current smoker
- Dyspnea
- History of CVA/ CHF
- Blood urea nitrogen level
- Chronic steroid use

Specific pulmonary risk factors include chronic obstructive pulmonary disease, preoperative sputum production, pneumonia and obstructive sleep apnea.

Based on these parameters, the pulmonary risk class assignment is done.

Risk class	Post Operative pneumonia risk index	Probability of pneumonia (%)	Respiratory failure risk index	Probability of resiratory failure (%)
1	**0-15**	**0.2**	**0-10**	**0.5**
2	**16-25**	**1.2**	**11-19**	**2.2**
3	**26-40**	**4.0**	**20-27**	**5.0**
4	**41-55**	**9.4**	**28-40**	**11.6**
5	**>55**	**15.3**	**>40**	**30.5**

Based on the risk class, recommendations can be made to decrease post operative pulmonary complications. Smoking cessation (within 2 months before the planned procedure), bronchodialator therapy, encouraging pre operative exercises, antibiotic therapy for pre existing infections and pre treatment of asthmatic patients with steroids are to considered. Perioperative strategies include the use of epidural analgesia, vigorous pulmonary toilet and rehabilitation and continuing bronchodialator therapy. Post operatively patient can be encouraged to walk 3 miles in less than one hour several times in a week.

(ii) RISK ASSESSMENT SCORES IN TRAUMA

Trauma scores are developed to describe the severity of injuries, or the prognosis of a patient, and correlate surgical outcomes with severity. Injuries are graded according to the extent of damage and multiple injuries usually receive higher scores than isolated injuries.

Glasgow Coma Scale (GCS)

The GCS measures unconsciousness by considering three different aspects of the patient: eye opening (1–4 points), verbal response (1–5 points), and motor response (1–6 points). High values (maximum is 15) are associated with a normal mental function.

The Revised Trauma Score (RTS)

The RTS is based on blood pressure, consciousness (GCS), and respiratory rate. Each of these three physiological aspects is recorded in five categories (0–4 points each) and added. High scores correspond to normal values. This simple 0–12 points scale could be used as a triage score. The final RTS score value is calculated as the logistic function of a weighted sum of these three components. The RTS only covers the physiological response to an injury and does not directly measure the extent or severity of injuries.

Injury severity scale (ISS)

The ISS is one of the first trauma scores created, and was published in 1974. This anatomical severity score is based on the three most severe injuries in different body regions. The six body regions considered are: head, face, thorax, abdomen, extremities (including pelvis), and soft tissue. All injuries are graded according to the Abbreviated Injury Scale as minor (1), moderate (2), serious (3),

severe (4), critical (5), or maximal (6). The three worst injuries from different body regions are squared and then added to obtain the ISS. Thus, the ISS ranges from 1 to 75.

Trauma and Injury Severity Score (TRISS)

TRISS is the result of the Major Trauma Outcome Study. It combines the following three most important and independent predictive factors: (1) anatomic injury severity, quantified as ISS; (2) the physiological response to these injuries, quantified as RTS; and (3) the age of the patient. Different formulas for patients with blunt and penetrating injuries provide a probability of survival as the final TRISS score. Many trauma registries use the TRISS or updated and modified versions of this score.

Revised Injury Severity Classification (RISC)

RISC was developed in a large trauma registry (Trauma Register of the German Trauma Society) to improve outcome prediction. In addition to age, physiology, and injury severity, it also takes into consideration the first laboratory values upon admission, such as base deficit or coagulation marker (partial thromboplastin time, international normalized ration, hemoglobin) and prehospital cardiac arrest.

TASH

The TASH score determines the probability of a patient needing a mass transfusion (defined as 10 or more units of blood). This easy-to-calculate score could increase the preparedness for blood transfusion when a patient with severe bleeding is admitted, or it can easily be included in treatment algorithms. The score uses blood pressure, heart rate, hemoglobin, base deficit, initial ultrasound results, femur/pelvic fracture, and male gender as predictive factors.

(iii) QUALITY OF SCORES

Predicted and observed mortality and morbidity rates are frequently used to evaluate trauma scores. The following four aspects should be analyzed when the quality of a score is measured:

• Discrimination

• Precision

• Calibration

• Validation

Discrimination describes the ability of a score to separate survivors from non-survivors. Therefore mean score values (or predictions) should be as different as possible in the two groups. The most frequently used measure for discrimination

is the area under the receiver operating characteristic curve (AUC of ROC), a summary measure where all possible score values are used for prediction of survival (or death).

Precision is the extent to which a prognostic score (i.e., a score that provides a risk of death estimate for each case) is able to closely predict the mortality rate actually observed. Deviations of precision can occur if a rather old score is applied to actual data. A lack of precision will also be observed when a score is applied in a less-developed health care system.

Calibration is the extent to which the above mentioned precision is equally valid for low-risk and high-risk patients. Calibration is usually measured by the Hosmer-Lemeshow (HL) statistic which evaluates the precision in ten different subgroups of increasing risk of death.

Validation of the score means that the properties of a score (discrimination, precision, calibration) are evaluated on a different set of data. Developers of a score sometimes use only one part of their data for developing the score, and the remaining data for validation. A valid scoring system will show similar results in both datasets.

(iv) LIMITATIONS OF A SCORE

The usefulness of scoring systems in scientific research cannot be disputed. Scores are used for description, inclusion of cases, and even evaluation of outcome. Also, in comparative quality audits, scores are used to compare institutions with a varying case mix of patients. However, in routine care, the role of scoring systems is limited.

Prognostic estimates derived from a score should be carefully considered when applied to individual patients. What does it mean if a patient with an initial risk of death of 10 % (derived from a score) finally died? Was the score wrong? Was the treatment not optimal? These questions cannot be answered. A 10% risk of death means that on average, one out of ten similar patients would die. But the score cannot predict which patient will die. If such deaths in low-risk patients occur more frequently than one in ten, then it could be a matter of treatment quality. But in the individual case, this decision is not acceptable. In conclusion, a variety of scores exist and new scores will continue to be developed in the future. Scores are used mainly in clinical studies and audit of care. Their application to an individual patient is limited; however, some well-known scoring systems have become a type of common language for communication.

2.2. PRE OPERATIVE EVALUATION AND OPTIMIZATION

(i) *Cardiac evaluation*

A 12-lead resting ECG is a useful test for detecting abnormalities of rate, rhythm, myocardial perfusion or previous infarction. However, it may still be normal in the presence of extensive coronary artery disease. It should be performed pre-operatively in all patients over 60; patients undergoing cardiac, vascular or renal surgery; patients with hypertension, cardiovascular disease and taking cardiac medications; and patients with an irregular or abnormal pulse.

Patients who have had a recent myocardial infarction should, if possible, be deferred until six months after the event. Patients with preoperative cardiac symptoms or for major thoracic or vascular surgery might benefit from echocardiography or even coronary angiography. Patients with cardiac arrhythmias should have a 24-hour cardiac monitor, a cardiology opinion and pre-operative correction if feasible. Patients with pacemakers should have a pre-operative pacemaker check.

A general anesthetic agent can increase the risk of an acute coronary event by sudden increase in myocardial oxygen demand, or reductions in oxygen supply (hypoxemia, hypotension or anemia) can precipitate myocardial infarction in patients with ischemic heart disease.

(ii) *Thromboprophylaxis*

Measures which can reduce the risk of thrombosis can be classified as general, physical and chemical.

General measures include: cessation of smoking, avoidance of estrogen drugs for six weeks pre-operatively, adequate pre-operative hydration, pre-operative weight loss in obese patients, early postoperative mobilisation and avoiding restrictive pressure on calves.

Physical measures include TED (thromboembolic disease) compression stockings and intra-operative pneumatic calf pumping mechanisms.

Chemical measures essentially mean the use of heparin. Low dose, low-molecular-weight heparin is administered subcutaneously in the perioperative period. This reduces the DVT risk, without significant additional risk of bleeding. Unfractionated heparin is still occasionally used for DVT prophylaxis; it may be easier to reverse with bleeding emergencies.

Previous history of DVT, age, obesity, long operations, pelvic or lower limb surgery, pregnancy, high dose estrogen therapy, malignancy, heart failure, infections, inflammatory conditions, coagulation disorders including polycythemia, thrombocythemia and thrombophilia, and prolonged bed rest are the known risk factors for DVT.

(iii) Pulmonary evaluation

Anaesthesia and surgery have deleterious effects on respiratory function. Patients with pre-existing respiratory disease are much more likely to have postoperative respiratory problems. In addition, respiratory diseases have effects on other systems; most importantly, the cardiovascular system, increasing the likelihood of cardiovascular complications.

If the vital capacity is less than three times tidal volume then respiratory insufficiency is very likely after a laparotomy or thoracotomy, because the pain and muscle cutting cause the vital capacity to be reduced by about two thirds. By testing pulmonary function pre-operatively this can be preempted so it may be possible, either through employing minimally invasive surgical techniques or epidural anaesthesia, to prevent respiratory complications. If pulmonary function tests show there is pre-existing bronchospasm, there is an increased risk of sputum retention and pneumonia. This risk can be minimised by optimising medical therapy pre-operatively. This usually involves the use of bronchodilators such as salbutamol. Patients with pre-existing restrictive lung disease are at risk of postoperative respiratory failure through fatigue. By being aware of this risk, special measures can be employed to reduce this, by using minimally invasive techniques if possible.

(iv) <u>Renal evaluation</u>

Renal function can be assessed in terms of glomerular and tubular function. The GFR is estimated by measuring the creatinine clearance. This is calculated from the creatinine content of a 24-hour urine collection and the plasma creatinine concentration during this period. The serum concentrations of creatinine and urea (renal function tests) are much more convenient measures, but are less sensitive because the GFR must fall to about half its normal level before there is a significant rise in serum creatinine concentration. Serum urea level is also a poor indication of renal function as dietary protein will affect serum urea concentration, as can gastrointestinal bleeding. However, serum urea and creatinine levels and their ratios are useful in the investigation of renal dysfunction.

The renal tubules are responsible for reabsorption of water, glucose and amino acids. There are no simple tests which can measure tubular function quantitatively. However, a comparison of urine and serum osmolality measurements will show if a patient can concentrate their urine normally.

(v) Glycemic control

High levels of blood glucose leads to increased risk of infection, poor wound healing, osmotic diuresis and dehydration. The insulin deficiency may lead to keto-acidosis and protein catabolism.

A sliding scale is an infusion of insulin and glucose that varies the amount given according to the blood glucose level. Five percent dextrose is administered intravenously at 100ml per hour, with 50 units short-acting insulin in 50ml normal saline via an infusion pump given according to the regimen below. Patients must be closely monitored and have regular blood glucose tests.

GLUCOSE LEVELS	INSULIN UNITS/HOUR
<2	Give 50% glucose intravenously
2-5	0
5-10	1
10-15	2
15-20	3
>20	6 – arrange medical assisstance

Certain drugs can interfere with blood sugar control. The most common drugs to cause hyperglycemia are corticosteroids. Thiazide diuretics may also precipitate hyperglycemia in a minority of patients. Blood glucose can be lowered

by alcohol and phenytoin. It is also wise to use beta-blockers cautiously in diabetic patients, as they may mask the symptoms of hypoglycemia.

(vi) <u>Hematological evaluation</u>

A full blood count provides haemoglobin concentration, white cell count and platelet count. Haemoglobin concentration (12-16g/dl in male, 11- 14g/dl in female), is a measure of the oxygen-carrying capacity of the blood. White cell count (5-10 x 109/l) is raised in the presence of infection. Platelet count (150-450 x 109/l) is one measure of blood clotting. A FBC may also provide details of red cell morphology (e.g. microcytosis in iron deficiency, macrocytosis in folate deficiency) and white cell differential (e.g. neutrophilia, leucopenia).

Any patients on anticoagulants, with liver disease, or with a known clotting disorder should have pre-operative clotting studies. Clotting studies are important for patients having epidural anaesthesia as abnormal clotting can lead to spinal hematoma. The prothrombin time (11-13 secs) measures the clotting factors of the extrinsic pathway. It is prolonged in patients on warfarin, and those with liver disease or disseminated intravascular coagulation (DIC). The activated partial thromboplastin time (APTT) (<35 secs) measures the clotting factors of the intrinsic pathway. It is prolonged in heparin therapy, haemophilia and DIC. It used to be called the kaolin-cephalin clotting time (KCCT).

Standard Urea & Electrolyte estimation provides plasma concentrations of:

- Sodium (133-144mmol/l).
- Potassium (3.3-4.8mmol/l).
- Urea (2.5-6.5mmol/l).
- Creatinine (55-125μmol/l).

Pre-operative U & Es should be performed in all patients undergoing major surgery, and in all patients over 65 years. Patients with concomitant cardiopulmonary disease, hepatic or renal disease, or metabolic or endocrine disorders may have deranged U & Es. In addition, pre-operative U & Es should be checked in all patients with a history of diarrhoea or vomiting, or with malnutrition, or those who are taking medications which might affect U & E concentrations, e.g. diuretics, steroids, cardiovascular medications, or who are on an intravenous infusion.

(vii) <u>Hepatic evaluation</u>

All pre-operative patients with upper abdominal pain, jaundice, malnutrition, known hepatic dysfunction, a history of alcohol abuse, or who are taking hepatically-metabolised medication should have pre-operative Liver function tests.

LFTs provide plasma concentrations of:

- Bilirubin (3-25μmol/l).
- Alkaline phosphatase (30-120iU/l).
- Alanine transaminase (ALT)/aspartate transaminase (AST) (10-60iU/l).
- Albumin (39-50g/l).
- Gamma-GT (10-80iU/l).

In addition, emergency pre-operative patients with abdominal pain should have amylase estimation.

Excessive bleeding is a major risk in patients with deranged liver functions. It is due to reduced absorption of vitamin K, leading to reduced synthesis of clotting factors II, VII, IX and X, causing increased prothrombin time. Portal hypertension causing hypersplenism may also lead to thrombocytopenia and reduced platelet activity. Hypoalbuminemia leading to fluid overload is common in jaundiced patients. This may lead to pulmonary or peripheral oedema, or ascites. Hypoalbuminaemic patients also have poor wound healing. The risk of infection is increased as the high levels of bilirubin suppress the immune system. Renal failure may also occur due to absorption of endotoxin from the gut leading to hepatorenal syndrome. Depleted glycogen stores may precipitate hypoglycaemia. Many drugs,

including anesthetic agents, are metabolised by the liver, so they may have a prolonged duration. Low serum albumin affects the action of drugs with high protein binding.

Certain special measures may be needed in patients with jaundice. Surgery should be avoided in jaundiced patients if possible. If the jaundice can be relieved pre-operatively, e.g. by endoscopic sphincterotomy or percutaneous transhepatic drainage, this should be considered. If surgery is essential, pre-operative vitamin K can be given, and fresh frozen plasma administered peri-operatively to facilitate clotting. Patients must be well hydrated pre-operatively and a loop or osmotic diuretic is given on induction to maximise renal output. Hepatorenal syndrome may also be prevented by pre-operative administration of lactulose or bile salts. Systemic, broad-spectrum antibiotics are given on induction as infection prophylaxis.

(viii) <u>Nutritional status evaluation</u>

Malnutrition is very common in pre-operative patients, and malnourished patients have higher morbidity and mortality rates. Causes of pre-operative malnutrition include:

- An inability to eat, e.g. gastrointestinal obstruction or previous stroke.
- A catabolic state, e.g. weight loss due to malignancy.

- Social factors, e.g. due to poor support.

Nutritional state can be assessed by history (e.g. poor diet, weight loss), examination (e.g. cachexia, muscle weakness, peripheral oedema) and various physical or biochemical parameters:

Physical:

- Body mass index measurement.
- Triceps skin fold thickness.
- Hand grip strength.

Biochemical:

- Serum albumin estimation.
- Transferrin levels.
- Haemoglobin level.

Malnourished patients are best treated by pre-operative nutritional optimisation. Pre-operative feeding can be performed prior to elective non-urgent surgery to improve nutritional status prior to surgery. Enteral feeding includes dietary supplementation or nasogastric or nasojejunal tube feeding. Parenteral feed

is administered intravenously. For emergency surgery, peri- or postoperative feeding is required.

(ix) <u>Immune system evaluation</u>

Patients who present with unusually severe infection, infection at unusual sites, recurrent infection or unusual pathogens should lead to investigations for immunosuppression. Various causes of immune suppression include

Congenital:

- Non-specific immunosuppression, e.g. chronic granulomatous disease, complement deficiency.
- Primary antibody deficiencies such as X-linked agammaglobulinaemia.
- T-cell deficiencies such as Di-George syndrome.

Acquired (most common):

- Alcohol excess, Smoking.
- IV drug abuse, HIV
- Poverty, Old age, Chronic illness
- Drugs, including steroids and immunosuppressants.
- Haematological cancer and its treatment.

Appropriate measures to optimise patients' general physical condition and specifically their immunological status should be taken to minimise risk of infection. Precautions are also taken to protect hospital staff in cases where a patient may present an infection risk, although nowadays most hospitals

accept that universal precautions should be adequate.

(x) Antibiotic prophylaxis

Prophylactic antibiotics are administered to reduce the incidence of postoperative infections. Thus, the antibiotics must be present at effective concentrations throughout the period of risk, they should be bactericidal and they should be appropriate to the sensitivities of the types of organisms likely to be present. They should not be harmful to the patient (allergies should be checked before administration). Prophylactic antibiotics are used in instances when either the risk of infection is common due to the presence of potentially infective bacteria, e.g. colorectal surgery, or when infection is rare but the consequences are catastrophic, e.g. with implanted orthopaedic or vascular prostheses. High risk patients can be classified into three groups:

- Normal healthy people having contaminated procedures.
- Immunocompromised patients.
- Patients with anatomical abnormalities (prosthetic implants/ heart valves)

(xi) <u>Blood transfusion</u>

A healthy adult circulating blood volume is approximately 70ml/Kg. Of this, 40-50% will be cellular and the rest is plasma. If the patient is hypovolemic they will show signs of hypovolemic shock. The assessment of what is an adequate pre-operative hemoglobin level for patients undergoing elective surgery should be made on an individual patient basis. It should be based on the clinical condition of the patient and the planned procedure. Accurate estimations of the blood loss and appropriate replacement are necessary to use blood appropriately.

(xii) <u>Arterial Blood Gas Analysis</u>

Arterial blood gases provide the following:

- pO2 (10-14kPa, 75-100mmHg).
- pCO2 (4-6kPa, 35-42mmHg).
- pH (7.35-7.45).
- HCO3 (23-33mmol/l).
- Lactate (0.7-2.1mmol/l).

In addition, some blood gas machines provide information on oxygen saturation, base excess, hemoglobin concentration, and urea and electrolyte concentrations.

Blood gas analysis provides information on oxygenation, CO2 excretion and acid base balance. It is a measure of respiratory, renal and cardiovascular function. It is used as a baseline prior to major surgery, to identify occult respiratory failure and to elucidate other metabolic disturbances.

2.3 PRINCIPLES OF LAPAROTOMY

Laparotomy is the term for any open access to the peritoneal cavity and includes midline incisions as well as paramedian and oblique approaches. It is the traditional method of access for most visceral surgery. It is still the approach of choice for some trauma, many emergency presentations, and some extensive surgery.

(i) Elective laparotomy

In midline access,

- *Midline fascia (linea alba) incision.* At or above the umbilicus (preperitoneal fat reduces the risk of underlying bowel injury). The midline can be identified by the presence of oblique crossing/interleaved fascial fibres. Fascia is exposed, elevated with clips to generate negative intraabdominal pressure and sharply incised.

- *Access extension*. With blend diathermy in the midline.

- *Assessment of 'target' organ(s).* Depends on pathology expected, but consider these issues—'resectability' (tethering/involvement of vital, non-resectable structures), extent of resection (length or additional organs/ structures to remove) and mobility.

(ii) <u>Emergency laparotomy</u>

• *Bleeding*. Control by pressure (packs) initially rather than direct closure (clips or sutures); remove packs, starting with those least likely to cover bleeding sites; allow anesthetic 'catch up time'.

• *Assessment of 'non-target' viscera.* Traditionally performed, but less important with preoperative imaging (especially CT scanning). Done in logical progression, e.g. central (small bowel, omentum, transverse colon), left upper quadrant (LUQ) (spleen, stomach), right upper quadrant (RUQ) (liver, gall bladder), right flank (right colon, right kidney), pelvis (bladder, uterus, ovaries, rectum), left flank (left colon/ kidney).

• *Multiple visceral injuries*. 'Close and control' rather than 'restore and join'. Preventing contamination and visceral leakage are required, but restoration of anatomy/physiology can be deferred to subsequent procedures.

• *Contamination.* Seek out and treat all areas of pus/contamination. Frequently overlooked areas are subphrenic, subhepatic, interloop, ileal & pelvic. Wash should

be warm, copious, and repeated sequential dilutions rather than a single large washout. Large calibre drains to be used for heavily soiled areas (likely to recollect), consider repeat (re look) surgery in 24–48h.

(iii) Procedures in laparotomy

a) Distal radical gastrectomy

During open distal radical gastrectomy for gastric cancer, a careful inspection for metastatic disease is undertaken. If no metastatic disease is identified, the first step is to divide the avascular plane between the gastrocolic omentum and the transverse colon, separating the omentum from the transverse mesocolon. The pancreas, duodenum, and the origin of right gastroepiploic vessels are exposed. The right gastroepiploic artery is divided at its origin and all adjacent lymph nodes are swept towards the specimen. The left gastric is identified as it travels toward lesser curve and this vessel is followed back to its origin at the celiac axis. The left gastric artery is skeletonized and divided, sweeping associated lymphatic tissue toward the specimen. The coronary vein is just caudal to the artery and should also be ligated and divided as well. At the completion of this dissection, the anterior surface of the celiac axis and the aorta should be freed of lymphatic tissue.

The next step is to open the peritoneum over the common hepatic artery as it leaves the celiac axis and to follow this to the origin of the gastroduodenal artery. Dissect the hepatic artery and sweep the adjacent lymphatic tissue towards the specimen. Divide the right gastric artery. Kocherize the duodenum and dissect it from the anterior surface of the pancreas for 4–6 cm. Excise any visible lymphatic tissue along the superior margin of the pancreas, the splenic artery, and the paraduodenal region. The duodenum is then divided with a surgical stapler. Examine the extent of the tumor and divide the stomach at least 8–10 cm proximal to the tumor. Restoration of gastrointestinal continuity can be achieved with either a Billroth II gastrojejunostomy or a Roux-en-Y gastrojejunostomy.

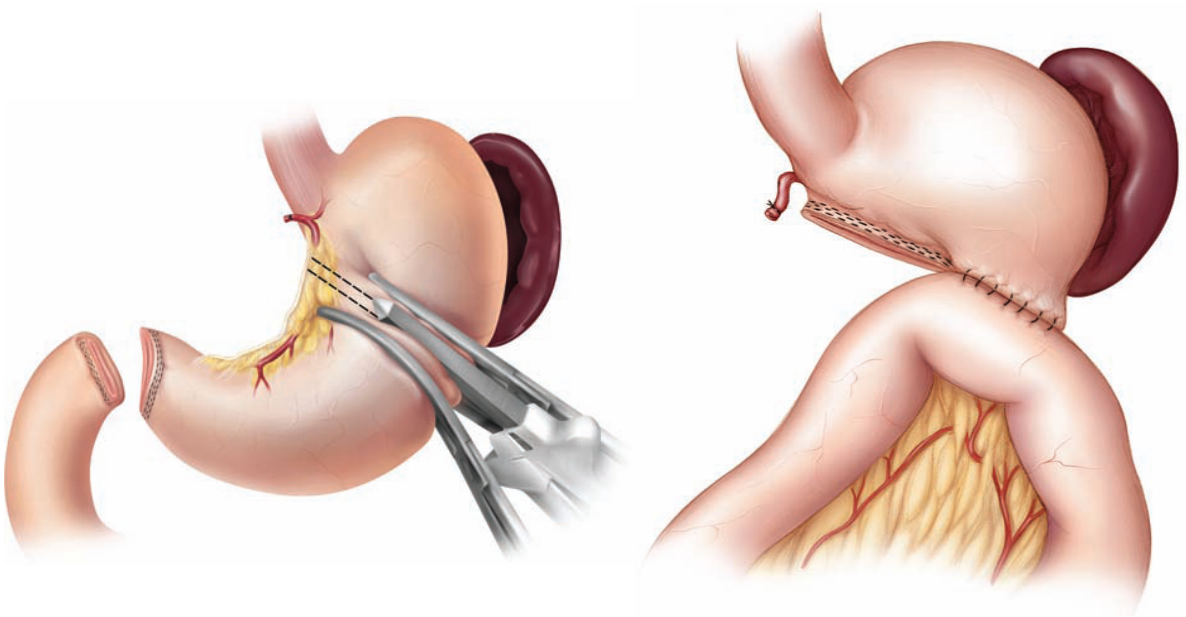


Fig 1. Distal Gastrectomy with Gastrojejunostomy

b) Small bowel resection

Once the diseased segment of bowel is identified, it is resected with its mesentery. This is of particular importance when dealing with neoplasms in order to get an adequate sampling of mesenteric lymph nodes. Identification and isolation of vascular arcades and their feeding vessels is facilitated by transillumination with the overhead lights. The arteries and veins are ligated with two ties and cut in between.

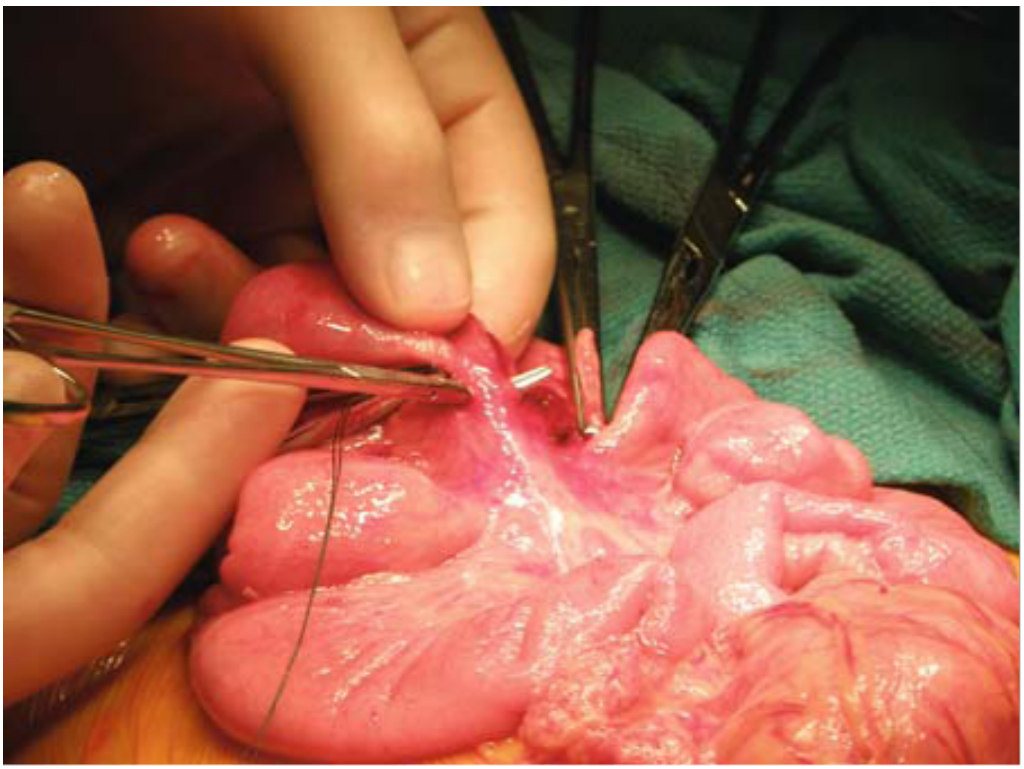


Fig 2. Small bowel resection - -Mesentric Vessel Ligation

The anastomosis of the bowel can be performed in a hand-sewn fashion or with a stapling device. A hand-sewn anastomosis is usually performed end-to-end in two layers. The inner layer is done in running fashion with full-thickness bites using monofilament absorbable suture (It assures hemostasis and guards against anastomotic bleeding.) The outer layer of the anastomosis consists of interrupted sutures placed in Lembert fashion. Stapled anastomoses are usually performed in a side-to-side fashion but function end-to-end. Small enterotomies are made on the anti-mesenteric corner of the end or each segment of bowel. Each arm of the stapler is introduced into each limb of the intestine. The anti-mesenteric walls of the limbs are aligned and the stapler is fired creating a large enteroenterostomy. The anastomosis is completed by stapling across the now common enterotomy created by the first stapling manoeuvre.

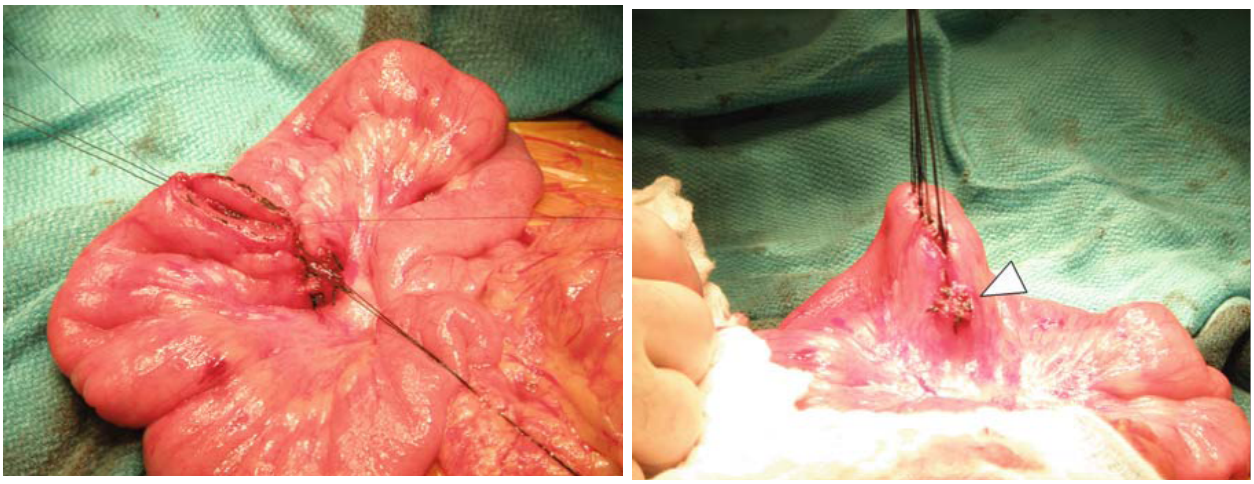


Fig 3. Small bowel resection and anastomises

c)Appendectomy

Using the convergence of the tenia coli as a landmark, the base of the appendix is located and exposed. The mesoappendix and appendiceal artery are taken between clamps and ligated with absorbable ties. The base of the appendix is crushed with a clamp and the proximal edge of the crushed segment is doubly ligated with 2-0 silk or absorbable suture. The appendix is amputated and sent to pathology for analysis. The exposed mucosa of the appendiceal stump is cauterized. "Dunking" of the stump with a purse-string suture around the base of the appendix is considered optional.

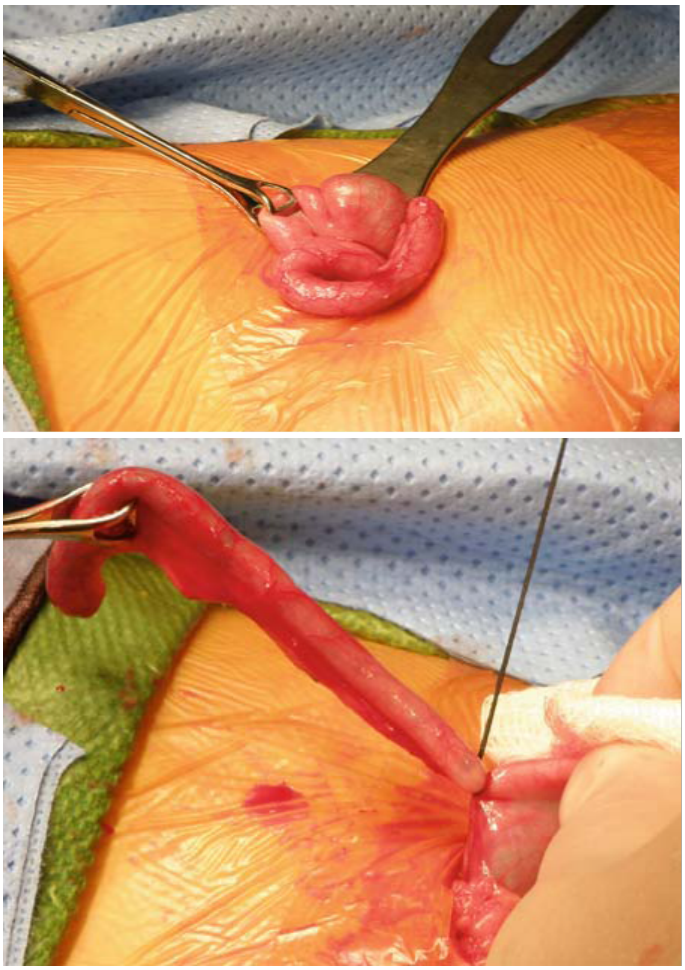


Fig 4. Appendicectomy

d) Right hemicolectomy

Upon entering the abdomen, the peritoneal reflection lateral to the cecum is incised and the terminal ileum is mobilized off the retroperitoneum. This dissection is continued distally along the lateral right colon and up to the hepatic flexure using electrocautery, making sure to avoid the right ureter as it passes anterior to the right common iliac bifurcation. It is necessary to identify the duodenum during mobilization of the hepatic flexure from the retroperitoneum, as the second and third portions may be injured by electrocautery during this step. The duodenum is kept posterior, mobilizing the colon anteriorly. The vessels contained within the hepatocolic ligament should be ligated and divided. This completes the mobilization around the hepatic flexure.

The omentum is then freed off the transverse colon at the distal resection site and divided using the clamp and tie technique to include as part of the resection specimen. The resection site should be chosen to allow at least a 5–10 cm distal resection margin. A window is created in the mesentery adjacent to the distal transection site. The marginal artery of Drummond is ligated and divided, and the transverse mesocolon is divided with electrocautery to the middle colic vessel bifurcation. The right branch of the middle colic vessel is ligated and divided at its origin and the left branch is spared. The right colic vessels are identified, ligated, and divided. The mesentery is further divided inferiorly to the base of the ileocolic

vessels, which are ligated with a heavy suture ligature and divided. The remaining small bowel mesentery is ligated and divided up to the terminal ileum. An area of the terminal ileum at least 5–10 cm proximal to the ileocecal valve is identified as the proximal margin. At this point the mesenteric resection is complete and preparation should be made for the ileocolic anastomosis.

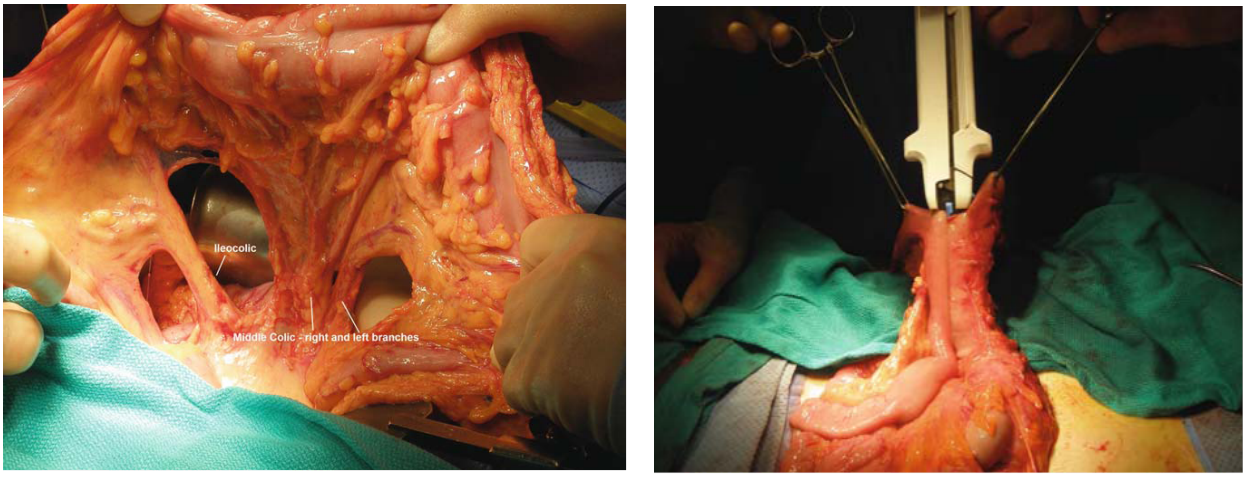


Fig 5. Right Hemicolectomy

The ileocolic anastomosis can be created using a side-to-side stapled approach. The bowel is divided on the stapler with heavy scissors. The specimen is inspected on the back table and sent to surgical pathology for further evaluation.

e) Sigmoid colectomy

The mobilization of the sigmoid colon begins by incising the lateral peritoneal attachments, while staying anterior to the retroperitoneal fascia. The left ureter and gonadal vessels are identified and maintained posterolaterally to avoid injury to these structures during the medially directed sigmoid mobilization. Once the sigmoid colon is mobilized, dissection is continued proximally with electrocautery. The splenic flexure of the colon may be mobilized if it is clear that further length will be necessary in order to complete a "tension-free" anastomosis. First, the renocolic ligament is incised, allowing the splenic flexure to descend, increasing the distance between the colon and the spleen. This allows safer transection of the lienocolic ligament, which should be made along the colon wall to prevent splenic injury. The omentum is divided from the distal transverse colon as necessary.

Upon completion of the mobilization, the ureter and the gonadal vessels are again identified posterolaterally prior to mesenteric division. For cases involving malignancy, the mesenteric division is taken at the root of the mesentery where the inferior mesenteric artery (IMA) and vein (IMV) are identified. The IMA is dissected, suture ligated, and divided. The IMV, which is lateral to the IMA, is then divided separately.The dissection of the mesentery continues and may include ligation and division of the ascending left colic artery (LCA).

Proximal ligation of the LCA helps to ensure adequate collateral blood flow to the proximal limb of the anastomosis from the left branch of the middle colic artery via the marginal artery of Drummond. The mesentery of the remaining colon is divided up to the bowel wall ensuring adequate mesenteric inclusion for cases of malignancy. The proximal and distal colon transections should be made in well-perfused bowel at least 5–10 cm from the tumor (in cases of malignancy) or proximally in an area of normal compliant bowel and distally at the rectosigmoid junction (in cases of diverticular disease). The proximal bowel is transected using a bowel clamp or a linear stapler

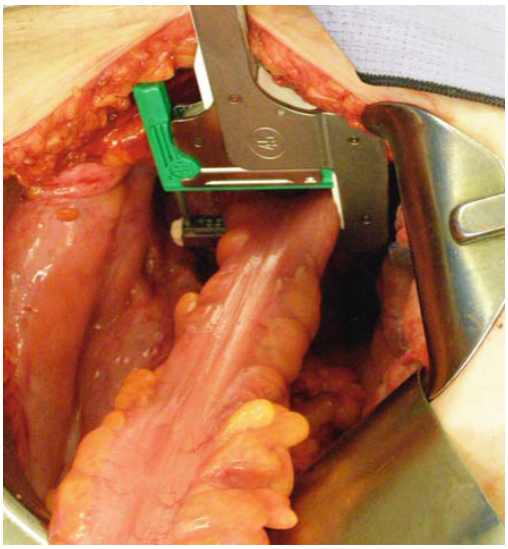


Fig 6. Sigmoid Colectomy

The anastomosis is begun by placing a purse-string suture at the proximal bowel clamp on the descending colon. The anvil shaft assembly of a circular stapler is then inserted into the lumen of the proximal bowel and the purse-string suture is tied to the groove on the shaft. The assistant then inserts the circular stapler transanally through the rectum and the center spike is delivered through the

rectal wall adjacent to the linear staple line. The anvil shaft is attached to the center spike and the stapler is closed and activated. The stapler is opened, removed, and inspected for two complete tissue rings, ensuring full circumferential tissue stapling.

f) Low anterior resection/ Abdominoperineal resection

Both the procedures begin with the sigmoid colon is retracted medially and the peritoneal attachments along the left lateral abdominal wall are carefully incised. The left ureter and gonadal vessels should be identified, which lie in close proximity to the mesentery of the rectosigmoid. The peritoneal attachments are further incised up to or including the splenic flexure, if necessary, in order to facilitate future tension-free anastomosis. Next, the rectosigmoid is retracted to the left to expose the mesentery. The inferior mesenteric artery (IMA) is then palpated and/or transilluminated to further identify its base and branches. A window is made behind the IMA and the hypogastric nerves are visualized and carefully kept posterior. The vessel may be ligated distal to its ascending left colic branch ("low" ligation) or at the root of the aorta ("high" ligation). Similarly, the inferior mesenteric vein is ligated and divided. Finally, the distal sigmoid colon is divided, usually with a linear stapler and the proximal portion is replaced into the abdomen and retracted during the remaining pelvic dissection.

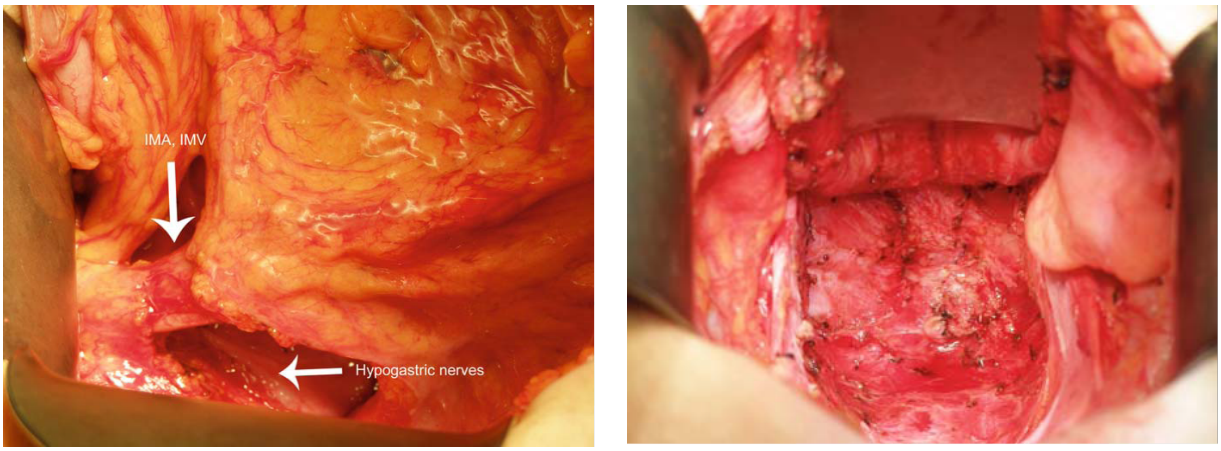


Fig 7. Total Mesorectal Excision

A total mesorectal excision is facilitated by retracting the divided colon anteriorly toward the pubis to identify the avascular plane posterior to the mesorectum. Incision of the areolar tissue posterior to the rectum along the endopelvic fascia is performed with electrocautery. This posterior dissection is continued down to the level of the pelvic floor. Care is taken to identify and preserve the hypogastric nerves, which are important for postoperative sexual and urinary function. These nerves can be seen and palpated at the sacral promontory, dividing bilaterally, and following the pelvic sidewalls. The peritoneal reflection is incised bilaterally as well as anteriorly and dissection in the mesorectal plane is continued circumferentially. Laterally, supporting 'ligaments' that may contain the middle rectal vessels and splanchnic nerve branches are carefully divided with cautery, maintaining the proper plane. In males, the seminal vesicles are visualized and kept anterior to the dissection. Similarly, in females, the posterior vaginal wall can be visualized and is carefully dissected within the rectovaginal septum.

Preservation of the fascia propria, which envelops the specimen, prevents tumor spillage and has been shown to reduce local recurrence.

Low anterior resection

A distal margin of 2 cm is customary, though less may be acceptable if an adequate margin can be obtained without compromising the sphincter complex. An angled clamp is placed across the bowel distal to the tumor. A transverse, non-cutting stapler (30 or 45 mm) is placed at the distal most portion of this dissection and the rectum is divided. Alternatively, the anorectum is divided within the anal canal to obtain an adequate margin and facilitate a coloanal anastomosis. The specimen is sent to surgical pathology after confirming an adequate distal margin.

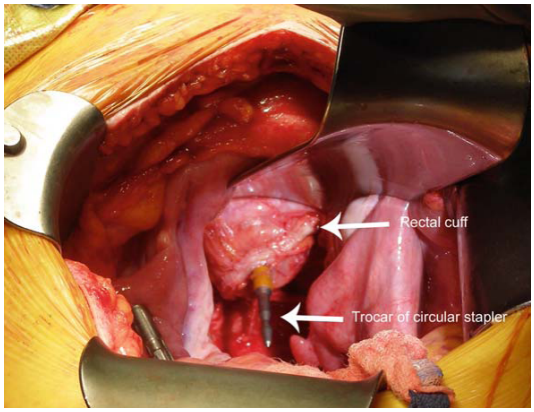


Fig 8. Low Anterior Resection

Several options for reconstruction exist. In tumors of the proximal rectum, an end-to-end anastomosis is appropriate. This anastomosis can be either handsewn or fashioned via a circular stapler.

Abdominoperineal resection

The abdominal phase of the APR procedure is identical to that of a LAR. After the complete abdominal mobilization of the rectum, the perineal phase begins. An elliptical incision is made around the anus including the entire sphincter mechanism. Dissection continues with cautery posteriorly until the coccyx is encountered.The anococcygeal ligament is then divided and the previous dissected presacral space is entered just anterior to the coccyx. The levator muscles are hooked with the surgeon's finger and divided bilaterally with cautery. The dissection continues anterolaterally. In males, the anterior portion of the dissection is challenging due to the membranous urethra and prostate. In females, retraction of the vagina facilitates separation of anterior rectum and posterior vaginal wall. Eversion of the specimen through the perineal opening may help facilitate the remaining anterior dissection plane.

The excision is completed circumferentially and the specimen is removed through the perineal wound. The levator ani muscles may be reapproximated in the midline if possible. The perineal incision requires closure in several layers to reduce wound complications. The procedure concludes with creation of an end-sigmoid/descending colostomy.

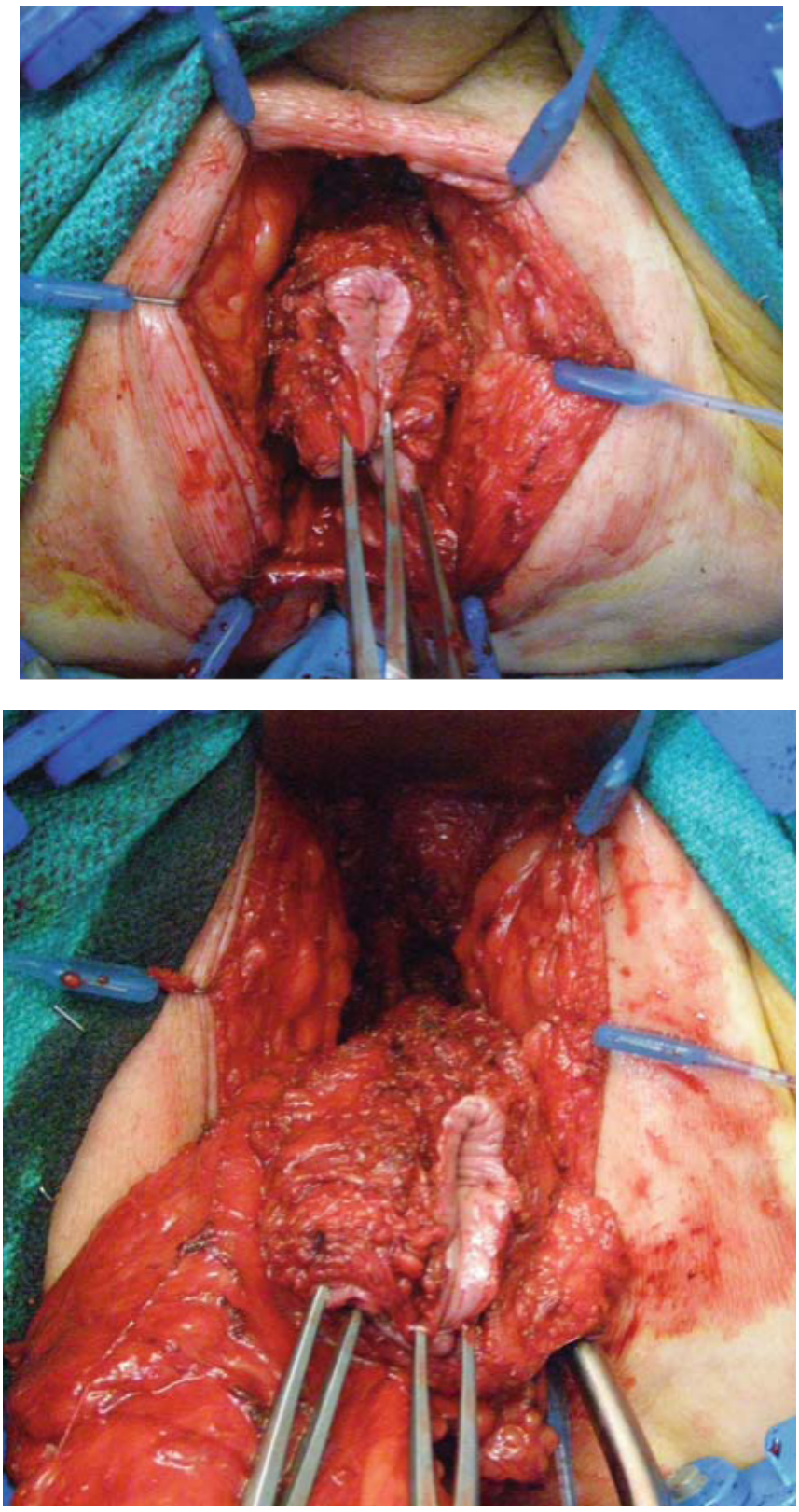


Fig 9. Abdomino - Perineal Resection

g) Stomas

Once an adequate length of bowel has been mobilized, the ostomy begins with a circular skin incision measuring 2–4 cm in diameter at the pre-marked site. Using electrocautery, a disk of skin is excised, leaving some of the subcutaneous fat behind, which will serve to support the bowel at the abdominal wall and prevent retraction. The rectus muscle is separated in the direction of its fibers with simple retraction and not divided. The posterior sheath is exposed. The posterior fascia and peritoneum are divided with electrocautery.

While keeping a finger through the opening to preserve the tract, a Babcock clamp is carefully placed through the hole in the skin into the peritoneal cavity. The clamp is placed onto the bowel segment and bowel is gently pushed through the fascial defect, with care to avoid pulling the intestine and tearing the mesentery. For loop stomas, a Penrose drain passed adjacent to the bowel wall allows gentle traction during placement. The bowel should protrude 2–4 cm from the skin. At this point, the abdominal portion of the procedure is completed and the abdominal incision is closed, to avoid contamination when the bowel is re-opened during stoma maturation.

To properly evert the lumen, in the case of an end ostomy, three or four seromuscular absorbable sutures are then placed at each quadrant circumferentially around the bowel lumen. Once the corners are secure, simple interrupted sutures

are placed evenly around the lumen, starting inside-out through the entire thickness of the bowel and into the dermis. A clear stoma appliance is then placed over the everted bowel.

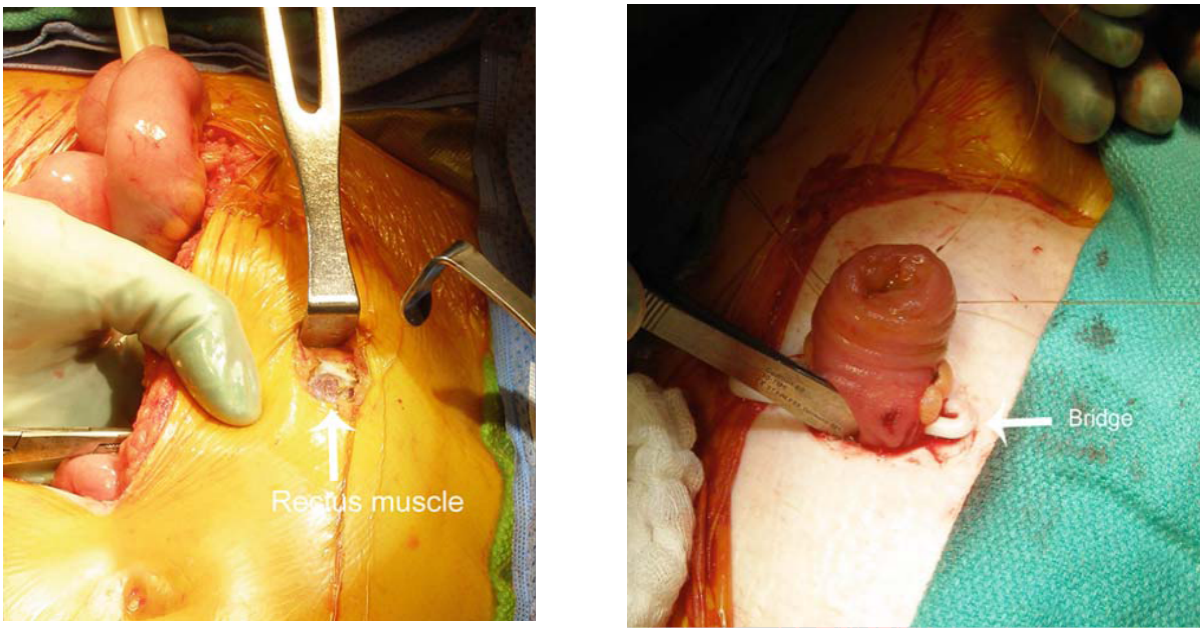


Fig 10. Stoma fashioning

h) Cholecystectomy/ CBD exploration

The peritoneum overlying the fundus of the gallbladder is incised. The peritoneum enveloping the gallbladder is incised along both sides of the gallbladder.The gallbladder is dissected out of the gallbladder fossa. The cystic artery is ligated and divided. The cystic duct is ligated and divided. The common bile duct is exposed in the porta hepatis. Stay sutures are placed on either side of

the planned choledochotomy and the common bile duct is opened. The common bile duct is explored, then closed over a T-tube.

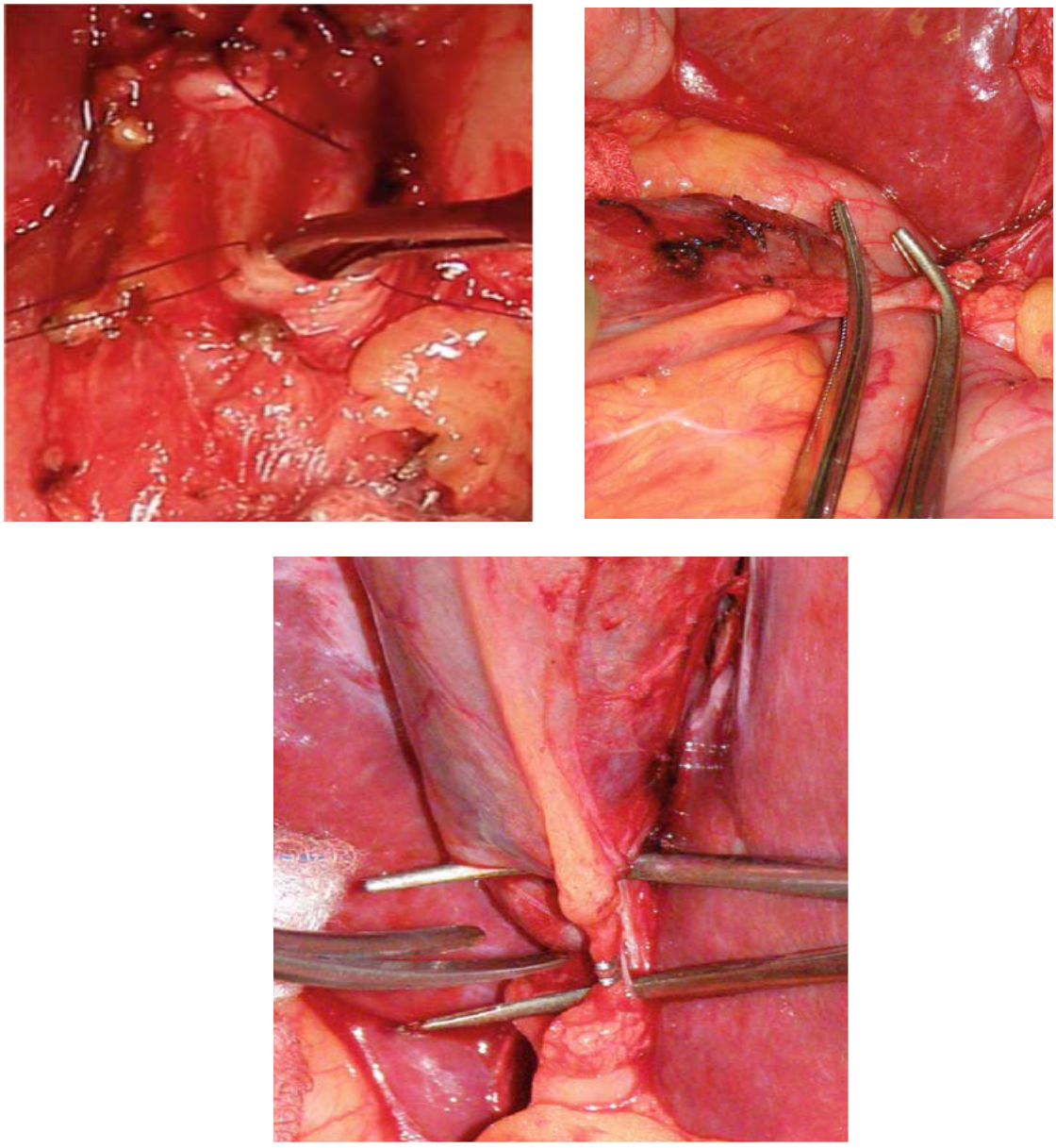


Fig 11. Cholecystectomy

i) Pancreaticoduodenectomy (Whipple's)

Once disseminated disease has been ruled out, the surgeon proceeds with mobilization of the duodenum and head of the pancreas by the Kocher maneuver. Dissection of the lateral peritoneal attachments of the duodenum, which facilitates inspection of the duodenum, head of the pancreas, and periampullary tumor is usually bloodless; an avascular cleavage plane can be easily developed as the posterior wall of the pancreas is bluntly separated from the underlying vena cava and right kidney. Extensive kocherization should be performed to allow the surgeon to be comfortable that there is no extension of tumor beyond the uncinate process. Special care should be taken to identify and preserve the right gonadal vein, which often runs parallel to the inferior vena cava at this point in the retroperitoneal dissection. Further mobilization of the second and third portion of the duodenum is carried out to adequately determine resectability of the lesion.

The lesser sac must be entered to facilitate visualization and mobilization of the pancreas. The greater omentum is retracted upward and the gastrocolic ligament is incised all the way to the splenic flexure, allowing entry into the lesser sac. The right gastroepiploic artery and vein are identified and a thorough evaluation of potential metastases above the pancreas and adjacent to the celiac axis lymph nodes should be performed. The middle colic vein with its origin at the superior mesenteric vein should be identified and confirmed to be free of tumor

involvement. The peritoneal attachments at the inferior border of the pancreas are incised and a cleavage plane over the superior mesenteric vein and behind the pancreas (the so-called “tunnel of love”) is developed.

The gallbladder is carefully dissected from the hepatic fossa. The cystic artery is identified, doubly clipped, and transected. Dissection should continue to the common bile duct where it is encircled with a vessel loop for subsequent transaction. The surgeon then proceeds to ligate the blood supply necessary for antrectomy. The right gastric artery is identified, ligated with 2-0 silk sutures, and subsequently transected. Next, the gastroduodenal artery (GDA), passing inferiorly from the hepatic artery at the point where the portal vein passes posterior to the pancreas, should be suture ligated with 4-0 Prolene sutures. Just before ligating and dividing the GDA, the vessel should be occluded with a vessel loop or bulldog clamp to ensure adequacy of the hepatic artery pulse. the right gastroepiploic vessels are ligated and tied.

After an area is cleared on both the greater and lesser curvature of the stomach, an antrectomy is performed using a GIA stapler. Once the stomach is transected, the remainder of the resection is carried out. The common hepatic duct is sharply transected just above the cystic duct. This not only allows the surgeon to perform a hepaticojejunostomy during the reconstructive phase of the procedure but also allows him or her to adequately visualize the portal vein. Attention is now

directed toward mobilization of the upper jejunum. The transverse colon is flipped superiorly, allowing for adequate visualization of the jejunum and its mesentery. The upper jejunum may be grasped with Babcock forceps and the bowel held up in order to adequately visualize the vascular arcades supplying the jejunum. The ligament of Treitz, in its avascular plane, is taken down with cautery. Utilizing incisions made in the avascular portions of the mesentery, the jejunum is divided with a GIA stapler. The jejunal arcades are divided and ligated to facilitate mobilization of the upper jejunum. A small opening is made in the mesocolon underneath the SMV and the mobilized upper jejunum is passed through the retrocolic window.

Reconstruction is began with hepaticojejunostomy, followed by a duct-to-mucosa pancreaticojejunostomy and completed with an end to side gastrojejunostomy.

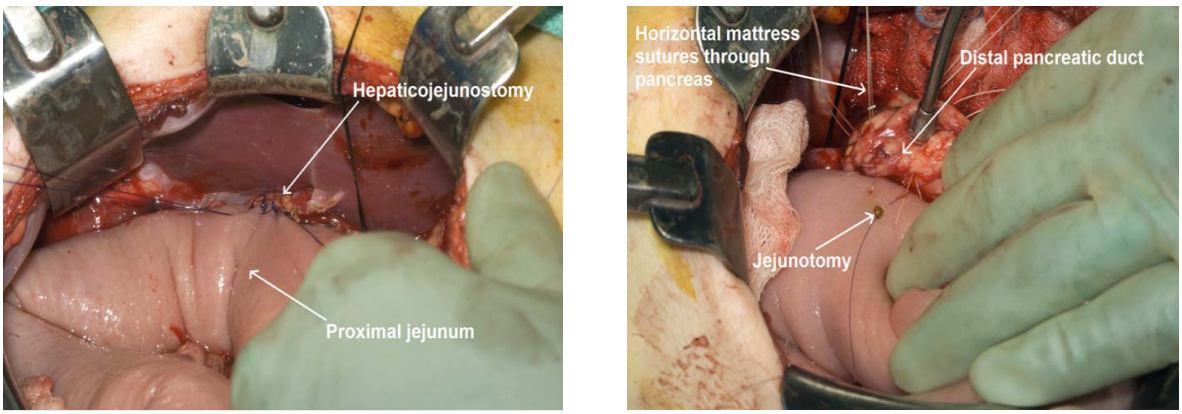
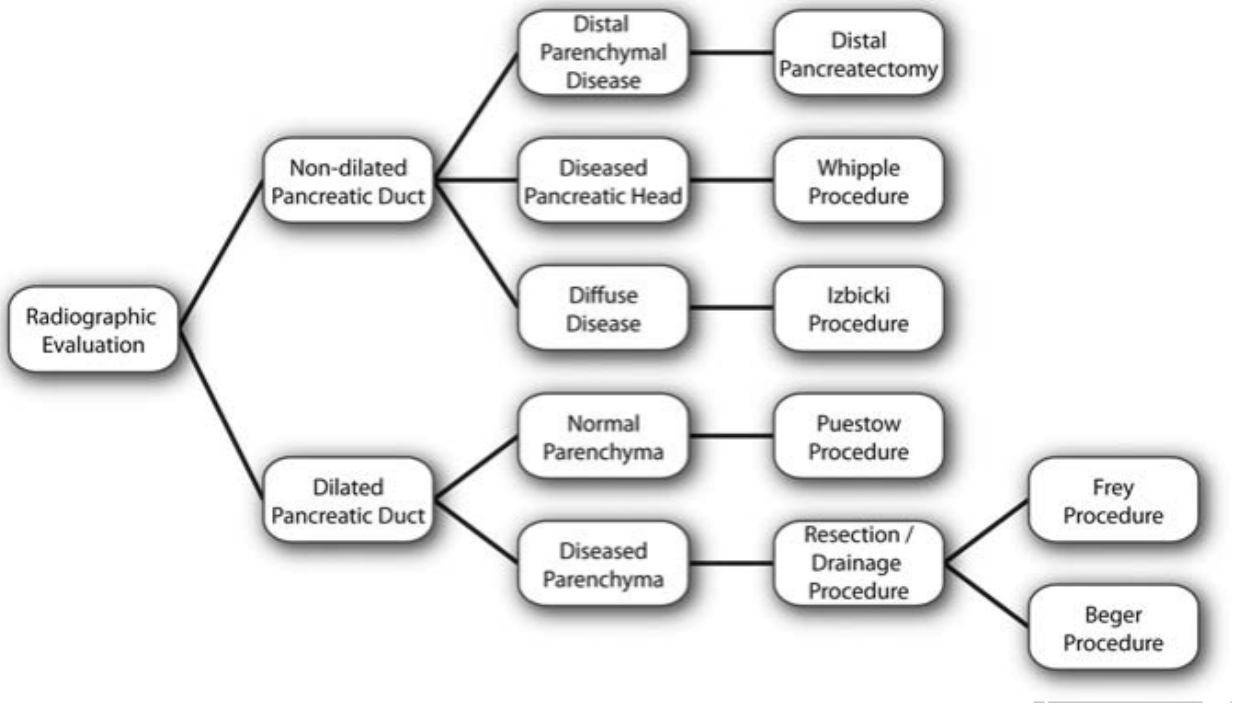


Fig 12. Classical Pancreaticoduodenectomy

j) Procedures for chronic pancreatitis

The choice of operation is dependent on pancreatic ductal anatomy and the extent of disease throughout the gland. Operations to palliate abdominal pain either (1) drain a dilated pancreatic ductal system or (2) resect diseased pancreatic parenchyma in cases in which the duct is of normal diameter. The main pancreatic duct normally measures 4–5 mm in the head of the pancreas and gently tapers throughout the body (3–4 mm) and tail (2–3 mm).



The choice of resection (distal pancreatectomy, pancreaticoduodenectomy, Beger procedure, Izbicki procedure) is dependent on the anatomical extent of disease.

k) Splenectomy

Open splenectomy is usually performed by a technique of medial mobilization of the spleen and dissection down to the pedicle of splenic artery and vein which is then finally divided. The procedure begins with mobilization of the spleen to the midline by division of the lateral and superior pole attachments. This includes division of the splenophrenic ligament superiorly, and the splenocolic and splenorenal ligaments at the lower pole. The short gastric vessels are then divided between ligatures or clips.

The spleen is medialized and hilar dissection performed carefully with isolation of the splenic vessels and gentle medial displacement of the tail of the pancreas to avoid pancreatic injury. In emergent cases, the splenic hilum may be clamped en bloc with three clamps in the manner of Federoff and divided and doubly ligated proximally and once distally.

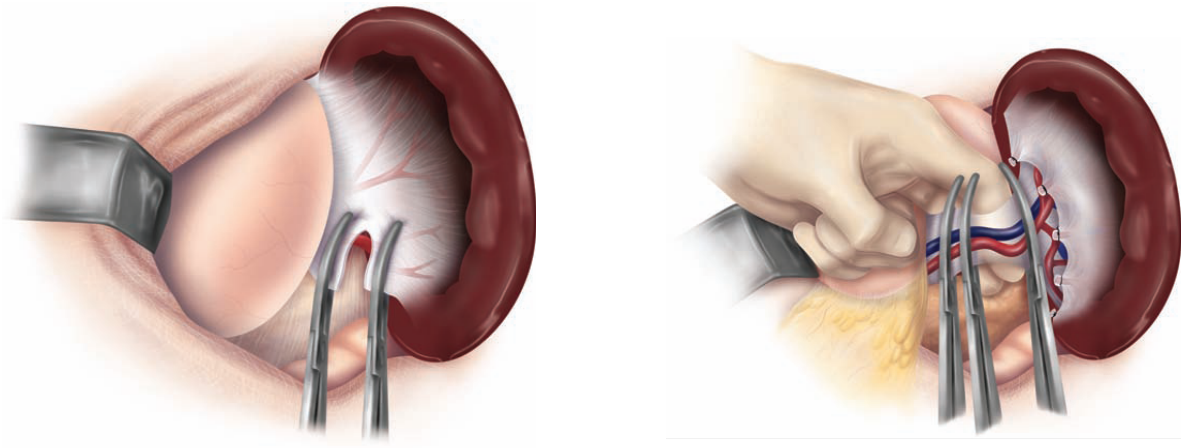


Fig 13. Splenectomy

2.4 POST OPERATIVE COMPLICATIONS

Classification of post operative complications

- Immediate - complications occurring at or immediately after surgery in the recovery room, e.g. postoperative airway obstruction.
- Early - complications occurring within 48 hours of surgery, e.g. reactive hemorrhage.
- Late - complications occurring 48 hours or more after surgery, e.g. pressure ulceration.

(i) Wound infection

The wound edges may begin to come apart and there may be a discharge from the wound (clear, bloody or purulent)

Mild wound infections may resolve spontaneously. More serious wound infections, with signs of inflammation, may require antibiotics. Initially, broad-spectrum antibiotics are administered; these can be changed later to targeted antibiotics based on sensitivities to cultured organisms.

In serious wound infections, or when there is a suspicion of a collection of pus, the wound needs to be laid open or a few sutures need to be removed.

The defect can then be allowed to heal by secondary intention or re-sutured when clean at a later date.

(ii) Wound dehiscence

Wound dehiscence is unplanned spontaneous re-opening of a wound following surgical closure. Partial dehiscence is the re-opening of the skin and superficial tissues; full dehiscence is total wound re-opening, so the floor of the wound or contents of the underlying cavity are exposed, e.g. burst abdomen.

Factors predisposing to wound dehiscence are

- Wound infection
- Poor surgical technique
- Poor blood supply
- Premature removal of sutures
- Chronic debilitated states.

Deep layers can be re-sutured with good surgical technique. For superficial layers, re-suture if clean or leave to heal by secondary intention.

(iii) Deep vein thrombosis

Thrombosis risks relate to Virchow's triad:

Stasis - postoperative immobility allows venous pooling leading to stasis and DVT.

Vessel wall - extrinsic compression of deep veins, e.g. following orthopedic or abdominal surgery.

Blood constituents - blood may be hypercoagulable in postoperative patients, with dehydration or malignancy.

Many postoperative DVTs are asymptomatic. DVT can present with a painful, red, swollen, tender, slightly warm calf or leg and low grade systemic pyrexia. DVT can present as pulmonary embolism. This is initially a clinical diagnosis, based on symptoms and signs, and a high index of suspicion. The diagnosis can usually be confirmed on colour duplex Doppler ultrasonography. Occasionally, a venogram is required in difficult cases.

(iv) Pulmonary embolism

Small pulmonary emboli may be asymptomatic. Some small or moderate PE may present with pleuritic chest pain, shortness of breath, hemoptysis and symptoms of hypoxia. Signs include cyanosis, tachycardia, pleural rub and low grade pyrexia. Some PE present more insidiously with signs of right heart strain.

Large PE may present with sudden onset severe shortness of breath, collapse and sudden death.

A high index of suspicion is required in postoperative patients with respiratory problems. Investigation includes blood gas analysis confirming hypoxia, an ECG (unreliable) which may show evidence of right heart strain with classic S1 Q3 T3 changes and a ventilation/perfusion (VQ) scan. The most reliable method of diagnosis is CT pulmonary angiography.

Immediate management involves oxygen by mask, intravenous fluids and anticoagulation, initially with intravenous or subcutaneous heparin. After diagnostic confirmation full anticoagulation with warfarin is required. Indications for a vena caval filter include ongoing pulmonary emboli despite adequate anticoagulation and loose or free-floating thrombus in the leg or pelvic veins as diagnosed on Doppler ultrasound. Other treatments include thrombolysis.

(v) Myocardial infarction

Postoperative MI can present in unusual ways and a high index of suspicion is required. It may not present with typical retrosternal chest pain radiating to the arm or neck. Many present without any pain at all, with recent onset heart failure (raised JVP, pulmonary oedema, hypotension) or arrhythmias, especially tachycardia or bradycardia. Nausea, vomiting, or tachypnoea may be present.

The signs may include pallor, cold and clammy skin, a gallop rhythm, lung crepitations and occasionally pyrexia.

The risk of having another MI after elective surgery is about 35% in the first three months after the original MI, and 15% in the next three to six months. After six months it is about 4%. Therefore, elective surgery should be avoided where possible for at least the first six months. The mortality from re-infarction may be as high as 30-40%.

(vi) Post operative pyrexia

Low grade postoperative pyrexia can be part of the normal response to trauma. Persistent, relapsing, or high grade pyrexia can be due to:

- Wound infection.
- Chest infection / Urinary tract infection
- Abscess formation - usually a high grade swinging pyrexia.
- DVT or PE.
- Infected pressure area sores.
- Infected lines, drips or tubes.
- Other – Malignancy, bacterial endocarditis, myocardial infarction (MI).

(vii) Cerebrovascular accident

Strokes or cerebrovascular accidents (CVA) are due to an interruption to the blood supply to the brain or an intracerebral bleed. Many of the risk factors for CVA can occur around the time of surgery: hypertension as a response to pain; hypotension due to anesthesia or hypovolaemia; hypercoagulability due to dehydration; and hypocoagulability due to the use of heparin. Also, arrhythmias such as atrial fibrillation are common postoperatively, and can precipitate thromboembolic CVA. Some operations, such as carotid endarterectomy and neck dissections, can dislodge thrombus and cause a thromboembolic CVA. Other surgical procedures, often vascular, where the blood clotting time is iatrogenically prolonged, increase the risk of hemorrhagic CVA.

The basic work up should include full blood count, coagulation profile, ECG, blood glucose and lipids. Ultrasound imaging of the heart (ECHO) and the carotid arteries may be useful in selected cases. MRI or CT imaging of the brain is now advised in all cases where there are grounds to suspect a CVA.

If the stroke is diagnosed quickly and the scan shows it is a thromboembolic type, then anti-thrombotic therapy may be appropriate, but often this is not an option postoperatively due to the risk of wound bleeding. Haemorrhagic stroke should be treated by correcting any clotting abnormality .

(viii) Pneumonia

Hospital Acquired Pneumonia is a new onset pneumonia starting more than 48 hours after hospital admission. It may be due to aspiration of organisms from the nasopharynx, or due to nosocomial infection from equipment, especially ventilation equipment. It may also be due to infective emboli from distant sites. Hospitalised patients are particularly at risk if they have impaired consciousness, an inability to cough and clear secretions, are immunocompromised or have prolonged ventilation. The pathogens involved are a much wider group than community acquired pneumonia and include gram negative bacilli such as Enterobacter and E. coli and gram positive organisms such as Streptococcus pneumonia. Postoperative HAP is more likely in those at extremes of age, smokers and the obese.

ix) Atelectasis and respiratory failure

Atelectasis is collapse of portions of the lung tissue, due to inadequate ventilation of the alveoli and failure to clear pulmonary secretions. It is common following surgery, especially with upper abdominal and thoracic incisions. Other risk factors include immobility, poor postoperative analgesia, over-sedation, smoking, malnutrition, age, obesity and preexisting respiratory disease.

A high index of suspicion is required for this complication, especially in patients with the above risk factors. Ideally, patients should stop smoking pre-operatively for elective surgery, and supplementary oxygen and physiotherapy with adequate analgesia should be administered routinely in the early postoperative period. Early mobilisation and minimal postoperative sedation are also required.

Untreated atelectasis can lead to established chest infection requiring antibiotics and aggressive physiotherapy. Later sequelae may include bronchopneumonia and pleural effusions, and may require ventilator support.

Respiratory failure occurs when the pulmonary gas exchange is sufficiently impaired to cause hypoxia with or without hypercapnia. There are two types:

Type 1 - PaO2 <8kPa and PaCO2 normal or low. This is due to a diffusion defect, a ventilation-perfusion mismatch or a left to right shunt.

Type 2 - PaO2 <8kPa and PaCO2 >7kPa (high). This is due to hypoventilation.

Arterial blood gas measurement is essential because it gives definitive measurements of the PaO2 and PaCO2 and leads most quickly to a diagnosis. Blood gas analysis also gives bicarbonate levels which can show if the patient is a chronic CO2 retainer (respiratory acidosis) as the bicarbonate level will be high due to compensatory renal alkalosis.

(x) Urinary retention/ infection

The inability to void in the postoperative period is most common in men with pre-existing prostatic hypertrophy. It occurs after lower abdominal surgery, e.g. inguinal hernia repair, or after removing the urethral catheter following other procedures. It may present with lower abdominal pain and distension, and the inability to pass urine. Occasionally it may present as urinary infection, postoperative distress or confusion.

(xi) Shock

Shock is an abnormality of the circulatory system that results in a situation where the body's metabolic and oxygen requirements cannot be met. It is not defined solely by blood pressure criteria and there is no laboratory test for it. It is recognised by the clinical manifestations of inadequate organ perfusion and oxygenation, such as pallor, confusion, tachycardia, tachypnoea, and oliguria. The causes of shock can be classified as.

- Hypovolemic - haemorrhage, fistulae, vomiting, pancreatitis, burns.
- Distributive - septic, anaphylactic, neurogenic.
- Cardiac - cardiogenic.
- Obstructive - cardiac tamponade, tension pneumothorax.

Hypovolemic shock is treated by restoration of circulating blood volume and arresting ongoing bleeding. This may require surgery or interventional radiology

Septic shock is managed by resuscitation as outlined as above, plus large dose intravenous broad-spectrum antibiotics, invasive monitoring and vasopressors if necessary.

Anaphylactic shock requires exactly the same protocol as outlined above, plus intramuscular adrenaline 500 micrograms. This can be repeated as required; corticosteroids and bronchodilators are also given.

(xii) Acute respiratory distress syndrome

Acute respiratory distress syndrome (ARDS) indicates the acute diffuse pulmonary inflammatory response to either direct or indirect insults from extrapulmonary pathology

Direct—via airway or injury to chest (e.g. aspiration, toxic gases, pneumonia)

Indirect—blood-borne insults (e.g. sepsis, polytrauma, severe burns, drugs)

Frequently associated with multiple organ (kidney, liver, intestines) dysfunction.

Can be diagnosed by the following criteria

- Blood gas analysis (PaO_2 / FiO_2 of less than 200 mm Hg)
- Chest X-ray shows bilateral diffuse infiltrates
- Pulmonary artery wedge pressure (less than 15 mm Hg).

Management includes supportive measures and no specific therapy exists to modulate the sequence of events of ARDS:

✓ Monitoring of all vitals

✓ Ventilatory management

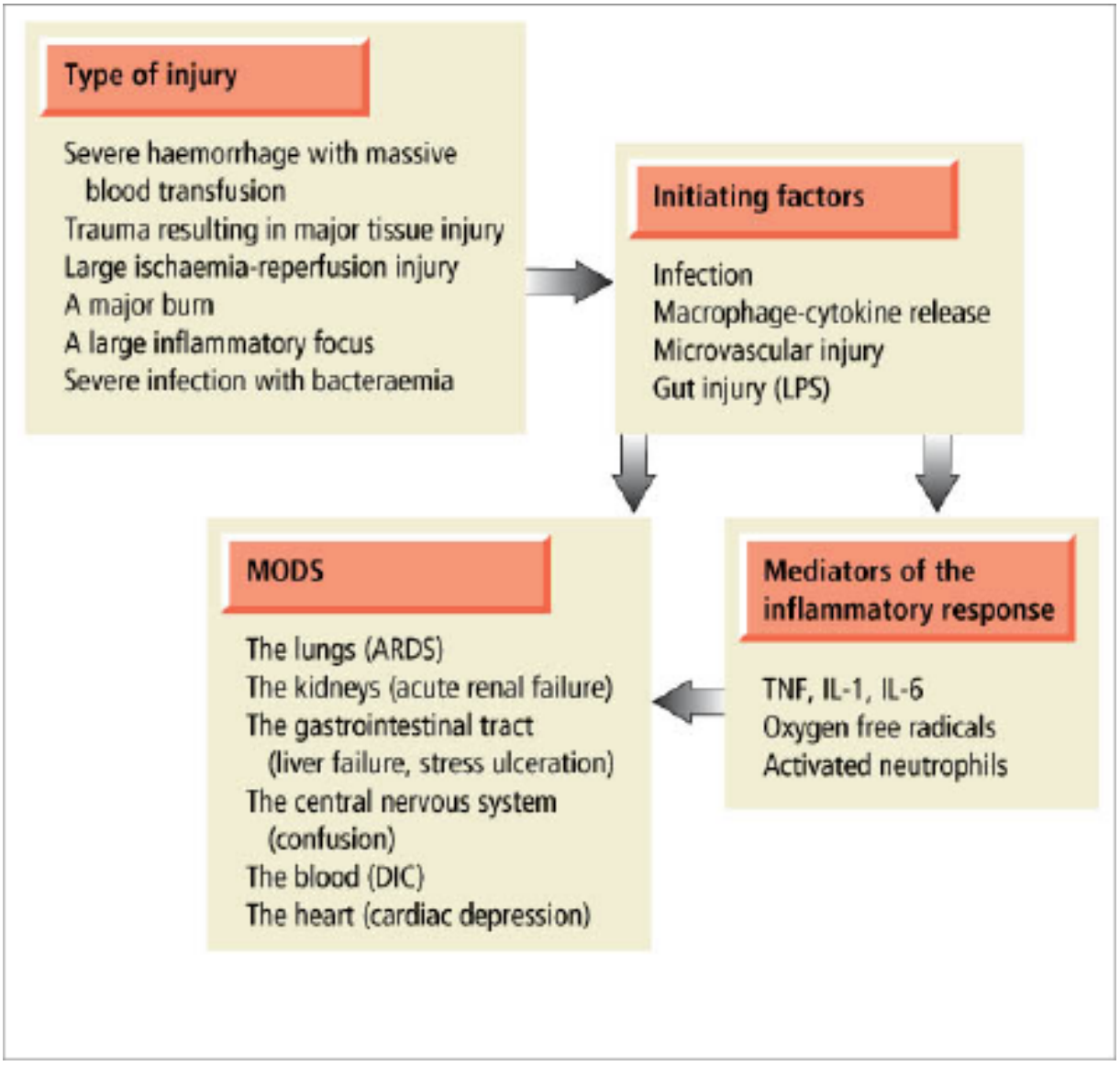
- ✓ Mechanical ventilation to permit adequate oxygen uptake

✓ Nonventilatory management

- ✓ Treatment of underlying risk factors
- ✓ Enteral feeding
- ✓ Maintenance of hemodynamic stability and cardiac output.

(xiii) Systemic inflammatory response syndrome/ multi organ dysfunction syndrome

The response to injury that occurs in the body and leads to this hypermetabolic state is called *systemic inflammatory response syndrome* (SIRS) and the sequence of failing end-organs is referred to as *multiple organ dysfunction syndrome* (MODS).



The patients at risk are those who have sustained a major biological insult, such as:

• severe hemorrhage requiring massive blood transfusion (e.g. liver trauma);

• trauma resulting in major tissue injury (e.g. crush injury);

• large ischemia-reperfusion injury (e.g. reperfusion of a limb following)

• major burn;

• large inflammatory focus (e.g. peritonitis, pancreatitis);

• severe infection with bacteremia (e.g. ascending cholangitis).

The general aims of therapy are to:

• treat infection

• ensure adequate tissue oxygenation;

• maintain nutritional support; and

• minimize systemic inflammation.

Management of the failure of the various end-organs must also be undertaken. Despite advances in organ support with volume ventilators, nutritional support and haemodialysis, MODS remains the leading non-cardiac cause of death in surgical patients, with a mortality of approximately 50%.

2.5 SURGICAL AUDIT

Many governments and national organisations in developed countries have developed important strategies aimed at delivering safety and quality in healthcare. One such measure is instituting nationalized clinical audits.

Clinical audit is currently seen as the most effective way of assessing routine health care delivery and the basis of improving outcomes. Audit of outcome or process can be divided into five stages: each stage needs to be carefully planned to produce a clinically effective audit.

Preparing for audit Choose a topic and define the purpose of the audit. One option is to identify (by consulting patients and clinicians) a potential problem that may involve high costs or risks for which there is good evidence to inform standards and that may be amenable to change. NICE stresses the importance of identifying skills and resources to carry out the audit.

Selecting audit criteria Audit can assess *process* or *outcome*.

• Define the patients to be included.

• Criteria to assess performance should be derived from the available evidence, e.g. trials, systematic reviews, society guidelines, or clinician consensus.

• Benchmarking prevents unrealistically high or low targets.

Measuring performance This is about collecting data. Identify patients or episodes from several sources (e.g. operating room logbooks and patient administration system (PAS)) to avoid missing patients because of incomplete data. Electronic information systems can improve data collection. Training dedicated audit personnel can improve the process further.

Making improvements Identify local barriers to change, develop a practical implementation plan, which should involve several interventions (practice guidelines, education, and training). Clinical governance programmes should provide the structure.

Sustaining improvements Repeating the audit to assess improvements is also called closing the audit loop. Alternatives such as critical incident review may be effective.

Chapter 3

MATERIALS AND METHODS

MATERIALS AND METHODS

3.1 Type of study : Prospective and Descriptive Study

3.2 Study approval : Prior to commencement of this study -

Ethical Committee of Stanley Medical College and Government General Hospital, Chennai had approved the thesis protocol.

3.3 Place of study : Govt. Stanley Medical College and Hospital

3.4 Period of study : Duration starting from 01 Oct 2014 to 30 Aug 2015

3.5 Sample size : 154 cases

3.6 Selection of patients:

a) **Sampling method-** Purposive**.**

b) **Inclusion criteria-** Patients of age group 12 to 90 years undergoing midline laparotomy.

c) **Exclusion criteria - -**

1) Patients who underwent abdomen surgeries other than midline laparotomies

2) Patients not responsive to resuscitation or died on table

3.7 Study procedure:

Method of sampling was non-random, purposive. After admission short history was taken and appropriate workup done on each patient admitted in surgery department for laparotomy. Baseline investigations, as routinely required, were done, followed by imaging studies. Patients were then explained about their disease process and the possible line of management. All the necessary information regarding the study was explained to the patients or their valid guardian. Informed written consent was taken from the patients or their guardian willing to participate in the study. Thorough physical examination was done in each case. Data collection sheets were filled in by the investigator himself. All of the preoperative factors related to the patient were noted down in the data sheet. After proper evaluation and preparation, patients who required surgical management were taken up for surgery. All patients were operated under general anesthesia. Strict aseptic precautions were followed during the operation. Meticulous techniques were practiced as far as possible. The operation procedure and related peroperative factors were observed directly and recorded in the data collection sheet instantly. After completing the collection of data it was compiled in a systematic way.

3.8 Ethical consideration : All the patients/ legal guardians were given an explanation of the study and about the investigative and operative procedures with their merits and demerits, expected results, and possible complications. If he/she agreed then the case had been selected for this study. The study did not involve any additional investigation or any significant risk. It did not cause economic burden to the patients. The study was approved by the institutional review board prior to commencement of data collection. Informed consent was taken from each patient/ guardian. Data were collected by approved data collection form.

3.9 Data collection : Data were collected by pre-tested structured questionnaire. Data were collected from all the respondents by direct interview after getting informed written consent from them or from their legal guardian. The physiological severity was scored on admission and operative severity at the end of 30 days

3.10 Data analysis : Data analysis was done both manually and by using computer. Calculated data were arranged in systemic manner, presented in various table and figures and statistical analysis was made to evaluate the objectives of this study with the help of Statistical Package for Social Science (SPSS).

CHAPTER 4

RESULTS

Table 1 : Prevalence of Elective and Emergency surgeries in study group

Surgery	Numbers	Percentage
Elective	65	42.2
Emergency	89	57.8
Total	154	100

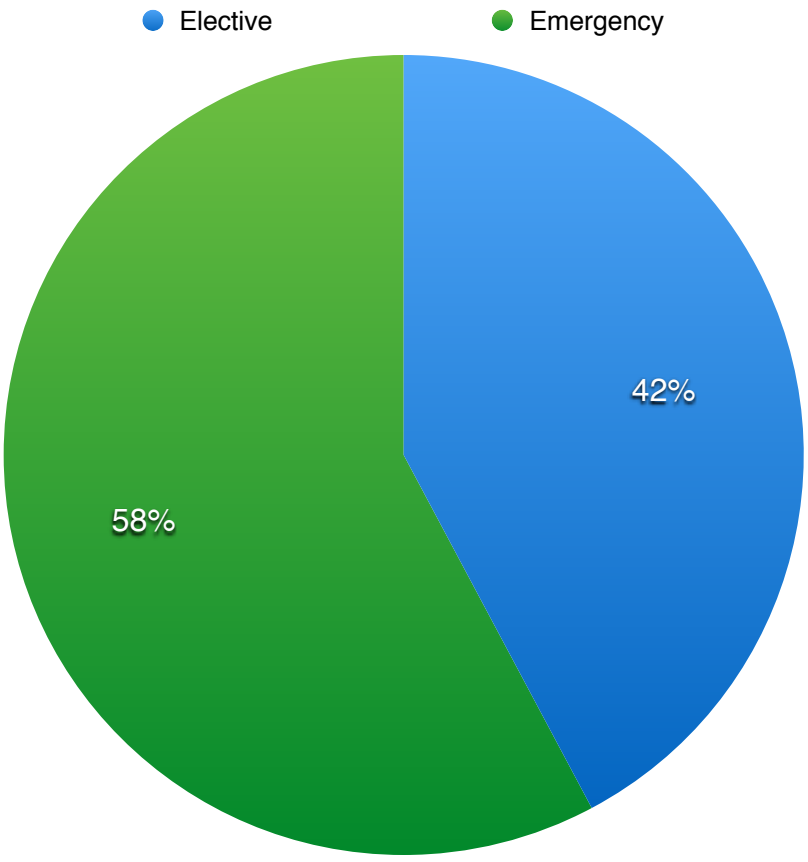


Table 2 : Age and Sex Distribution of patients in the study

Age / Sex	Elective			Emergency			Total
	Male	Female	Total	Male	Female	Total	
< 29	2	3	5 (3.2)	15	7	22 (14.3)	27 (17.5)
30 - 39	6	3	9 (5.8)	9	10	19 (12.3)	28 (18.1)
40 - 49	10	11	21 (13.6)	12	8	20 (13)	41 (26.6)
50 - 59	12	4	16 (10.4)	9	4	13 (8.4)	29 (18.8)
> 60	10	4	14 (9)	8	7	15 (9.7)	29 (18.8)
Total	40	25	65 (42.2)	53	36	89 (57.8)	154 (100)
Total	Male - - 93 (60.4)			Female - - 61 (39.6)			

* Figures in parentheses indicates percentages

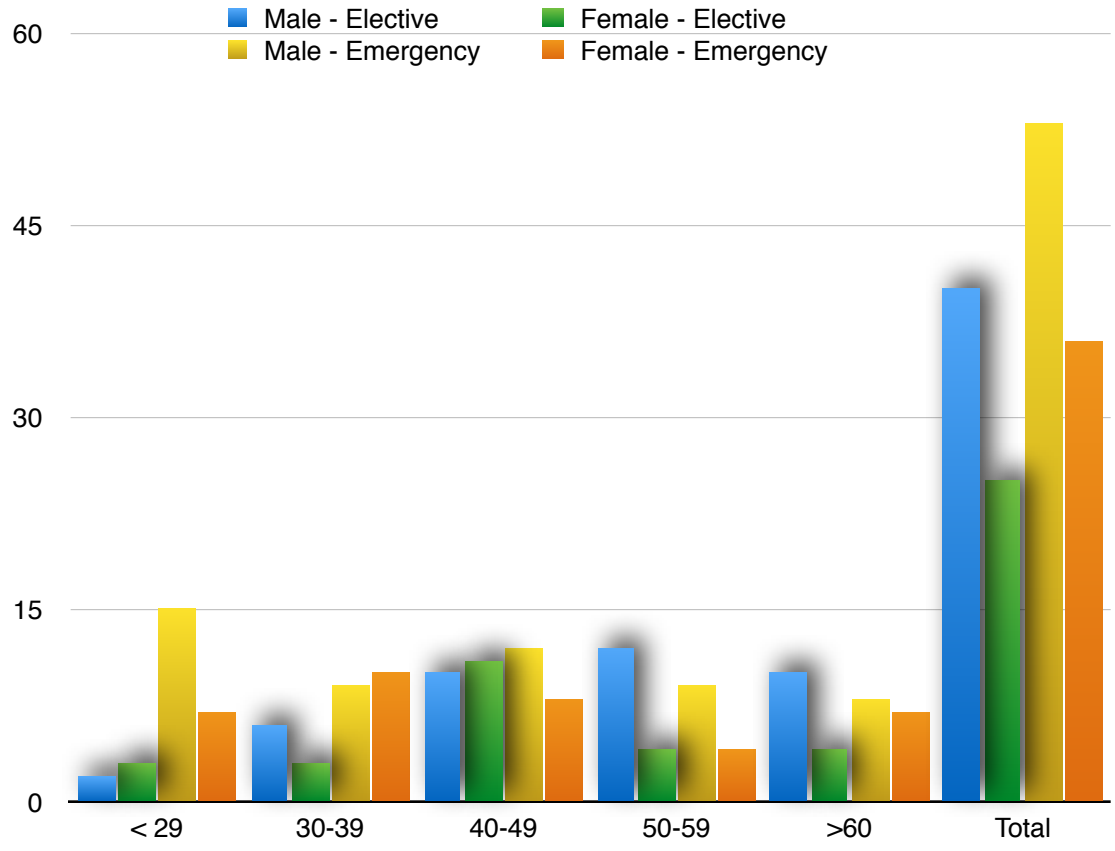


Table 3 : Prevalance of Risk Factors in patient group

Risk Factor	Elective	Emergency	Total
Cardiac Risk	1	5	6
Respiratory Risk	9	18	27
Total	10	23	33

Table 4 : Analysis of Vital Parameters in patient group

Parameters	Elective		Emergency	
	Within Range	Outside Range	Within Range	Outside Range
SBP	51 (78.5)	14 (21.5)	65 (73)	24 (27)
PR	62 (95.4)	3 (4.6)	11 (12.4)	78 (83.6)
GCS	65 (100)	0	78 (83.6)	11 (12.4)

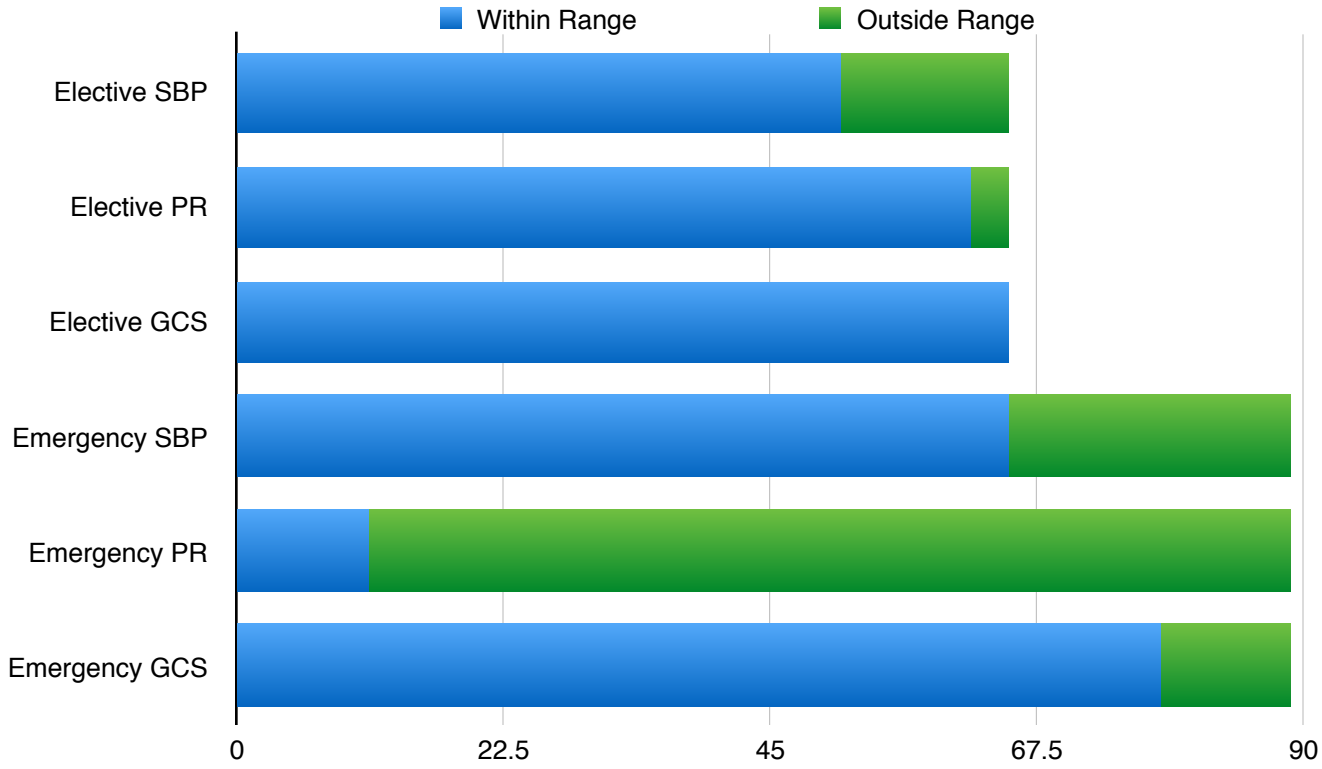


Table 5 : Analysis of Blood Investigations in patient group

Parameters	Elective		Emergency	
	Within Range	Outside Range	Within Range	Outside Range
Hb	60	5	73	16
TC	54	11	55	34
Urea	58	7	64	25
Na +	63	2	79	10
K +	51	14	53	36

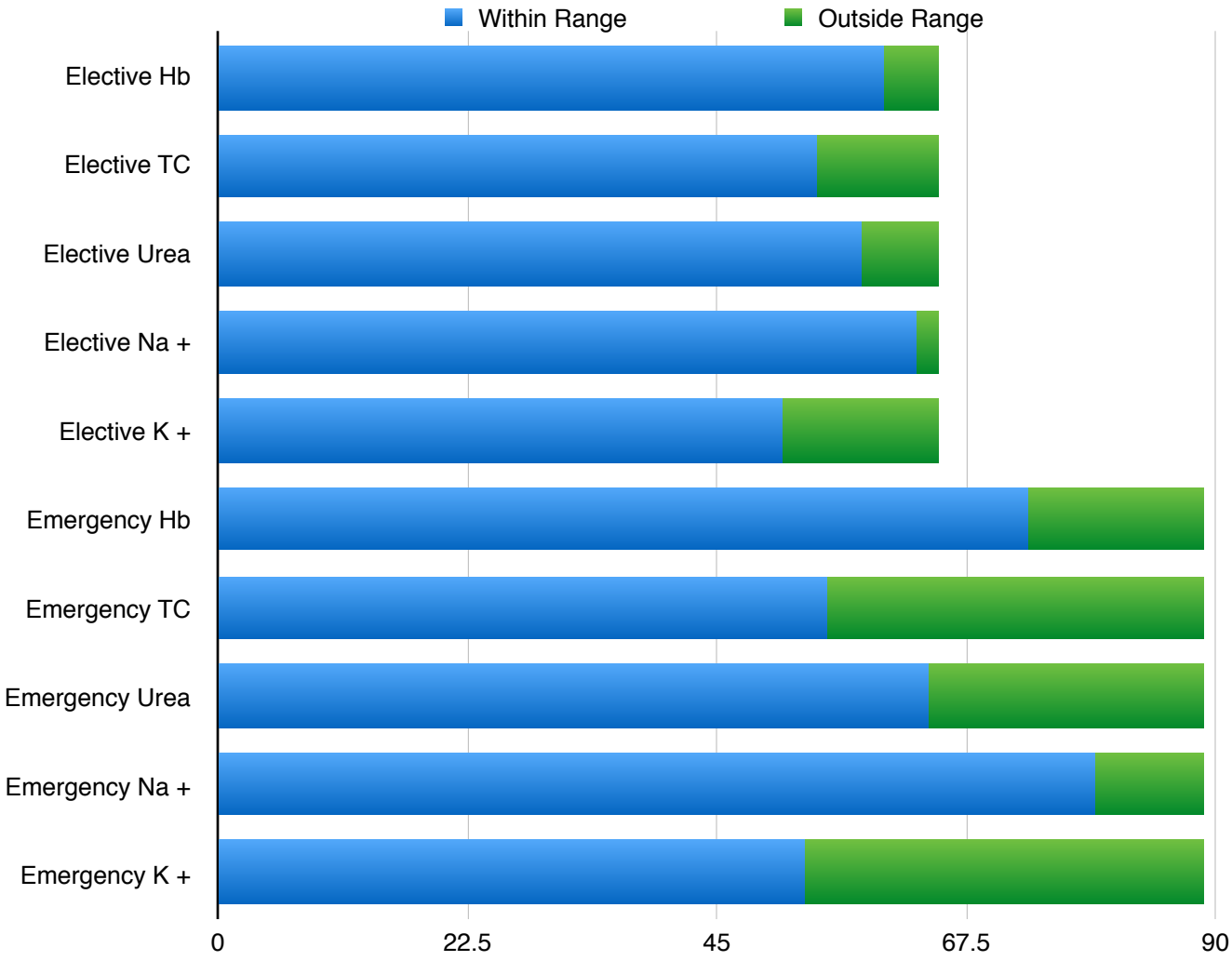
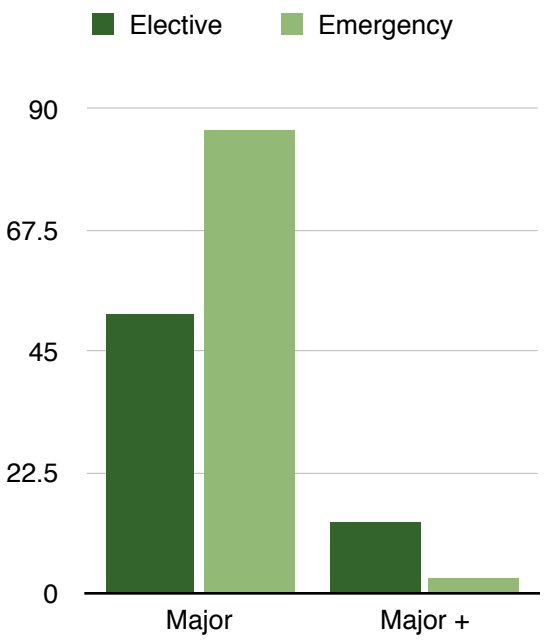
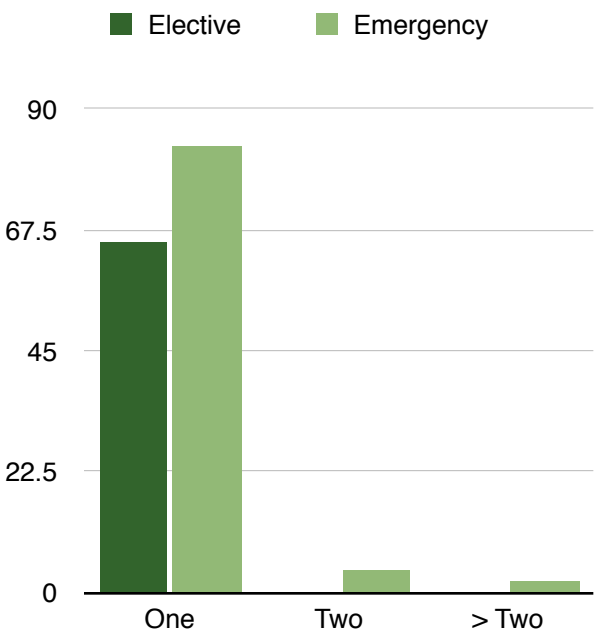


Table 6 : Analysis of Procedural Details in patient group

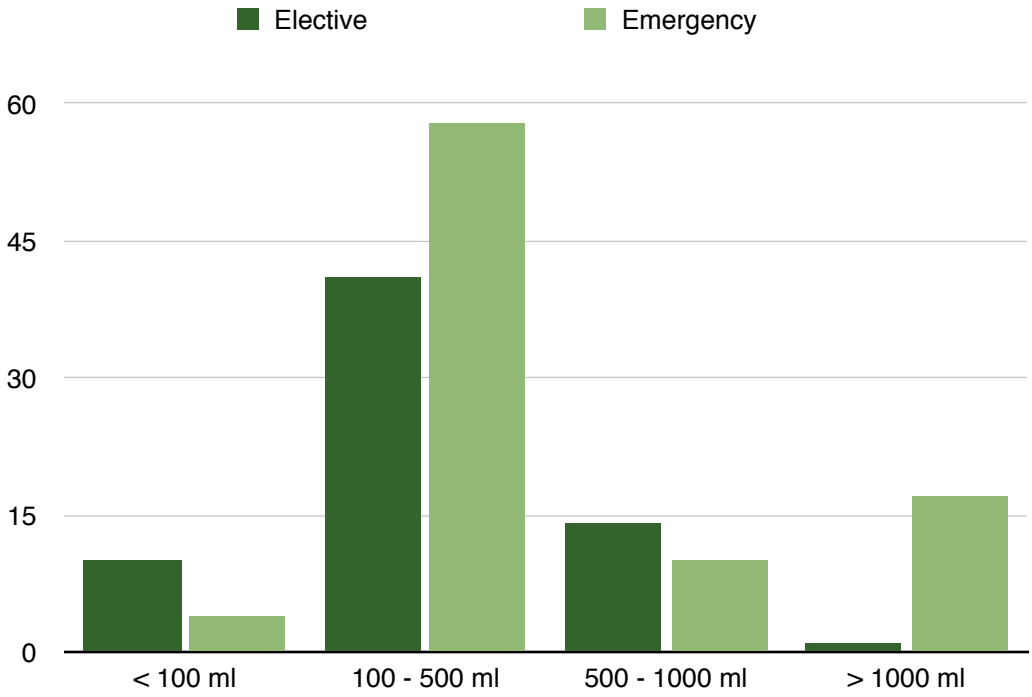
Procedure Details		Elective	Emergency
Operative Severity	Major	52	86
	Major +	13	3
No. Of Procedures	One	65	83
	Two	0	4
	> Two	0	2
Blood Loss	< 100 ml	10	4
	100 - 500 ml	41	58
	500 - 1000ml	14	10
	> 1000 ml	1	17
Peritoneal Soiling	None	64	27
	Local Pus	1	37
	Bowel Contents	-	16
	Blood	-	9
Malignancy	None	38	82
	Primary alone	6	1
	Nodal Spread	10	2
	Distant Spread	11	4



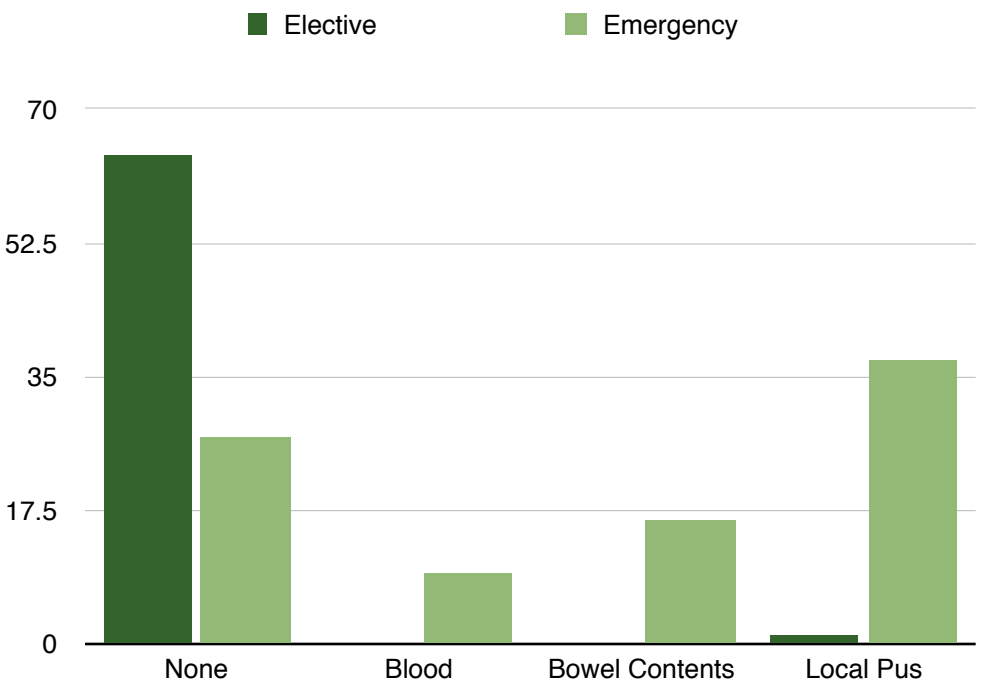
Operative Severity



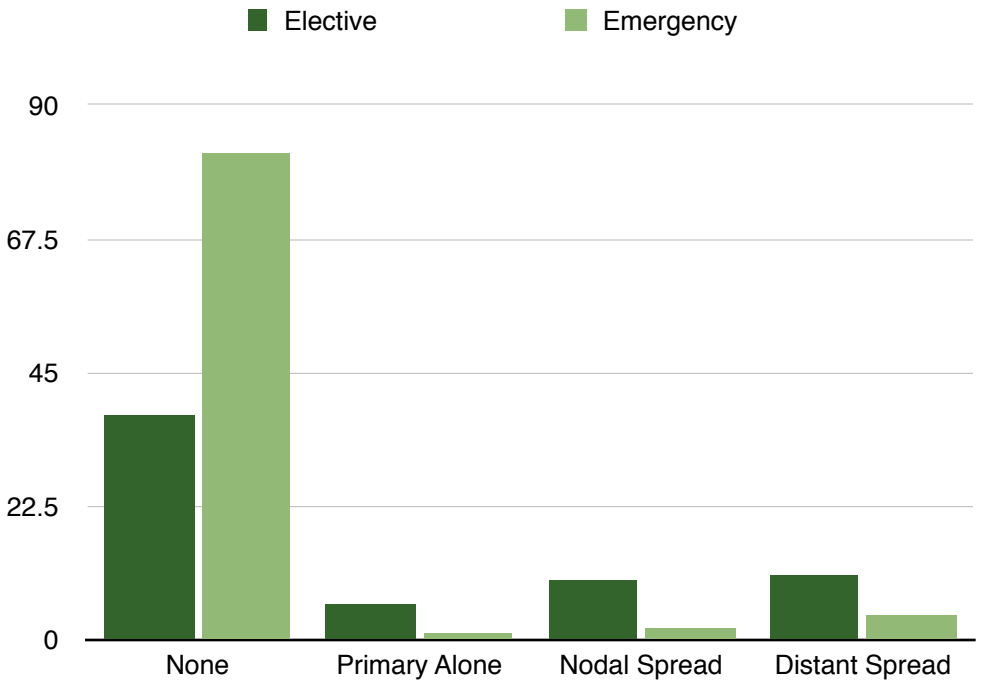
No. Of Procedures



Blood Loss



Peritoneal Soiling



Malignancy

Table 7 : Prevalence of Morbidity among the patient group

Morbidty	Elective	Emergency
ARDS	1	3
Basal Atelectasis	4	3
Anastomotic Leak	1	3
DVT	3	-
Wound Infection	1	9
Wound Dehiscence	1	11
Pulmonary Embolism	-	3
Pneumonia	1	6
Hypokalemia	1	-
AKI	-	4
UTI	1	4
Total	13 (20)	46 (51.7)
None	52 (80)	43 (48.3)
Total	65	89

Table 8 : Prevalence of Mortality among the patient group

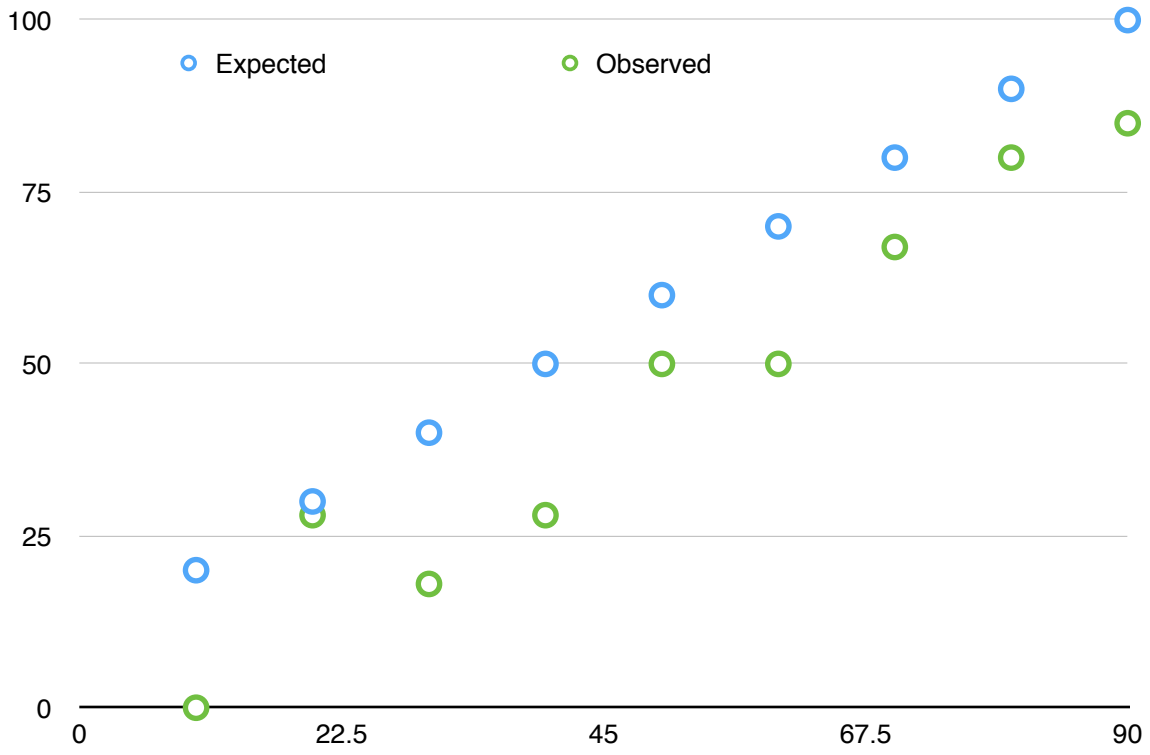
Mortality	Elective	Emergency
MODS	-	3
SIRS	-	1
Sepsis	-	1
None	65	84
Total	65	89

Table 9 : Comparison of POSSUM predicted morbidity with observed morbidity in our group of patients

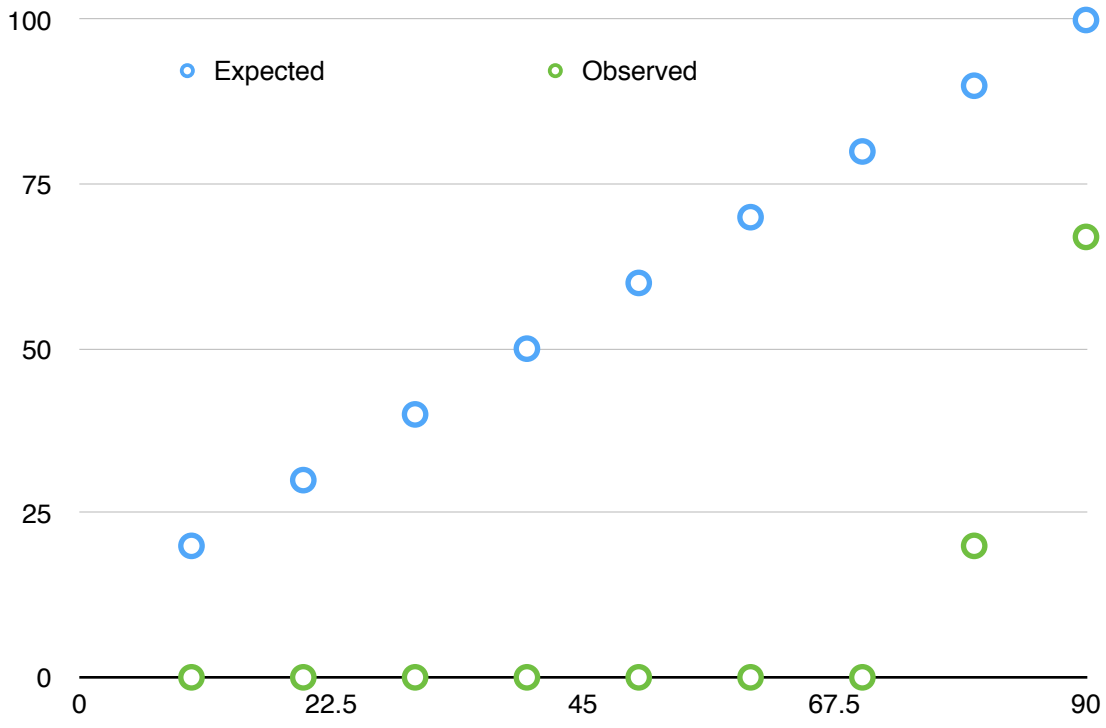
Expected Morbidity (in %)	Elective			Emergency		
	Total No. of Patients	Patients with Morbidity	%	Total No. of Patients	Patients with Morbidity	%
0 - 10	3	0	0	0	0	0
10 - 20	23	0	0	0	0	0
20 - 30	7	2	28	6	0	0
30 - 40	5	1	20	13	2	16
40 - 50	12	3	25	10	3	30
50 - 60	4	2	50	9	2	22
60 - 70	6	3	50	4	1	25
70 - 80	1	0	0	9	6	67
80 - 90	4	3	75	5	4	80
90 - 100	0	0	0	33	28	85

Table 10 : Comparison of POSSUM predicted mortality with observed mortality in our group of patients

Expected Mortality (in %)	Elective			Emergency		
	Total No. of Patients	No. of Patients died	%	Total No. of Patients	No. of Patients died	%
0 - 10	48	0	0	29	0	0
10 - 20	12	0	0	15	0	0
20 - 30	1	0	0	9	0	0
30 - 40	4	0	0	4	0	0
40 - 50	0	0	0	5	0	0
50 - 60	0	0	0	7	0	0
60 - 70	0	0	0	7	0	0
70 - 80	0	0	0	2	0	0
80 - 90	0	0	0	5	1	20
90 - 100	0	0	0	6	4	67



Expected to Observed Curve - - Morbidity



Expected to Observed Curve - - Mortality

Table 11 - Analysis for Significance of POSSUM score for morbidity

(Chi - Square Tests)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi Square	18.949 [a]	9	0.026
Likelihood Ratio	16.039	9	0.066
Linear by Linear Association	10.121	1	**0.001**
N of Valid Cases	154		

a. 11 cells (55.0%) have expected count less than 5. The minimum expected count is .10.

Table 12 - Analysis for Significance of POSSUM score for mortality

(Chi - Square Tests)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi Square	86.088 [a]	9	0.000
Likelihood Ratio	31.469	9	0.000
Linear by Linear Association	36.444	1	**0.000**
N of Valid Cases	154		

a - 12 cells (60.0%) have expected count less than 5. The minimum expected count is .06.

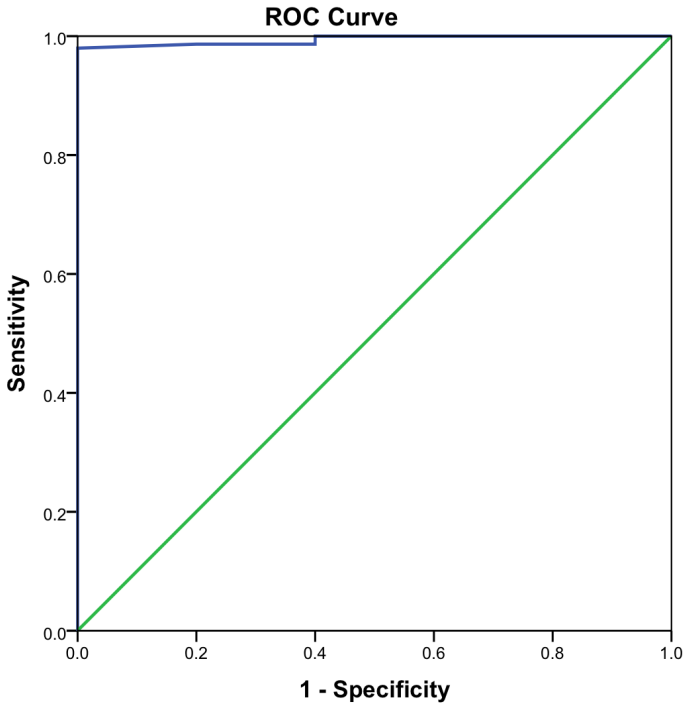
ROC CURVE FOR POSSUM PREDICTED SCORE FOR MORBIDITY

Case Processing Summary

Cause of death	Valid N (listwise)
Positive[a]	149
Negative	5

Smaller values of the test result variable(s) indicate stronger evidence for a positive actual state.

a. The positive actual state is 0.



Diagonal segments are produced by ties.

Area Under the Curve

Test Result Variable(s): POSSUM predicted morbidity

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.994	.006	.000	.983	1.000

The test result variable(s): POSSUM predicted morbidity has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

SENSITIVITY - - 98 %

SPECIFICITY - - 100 %

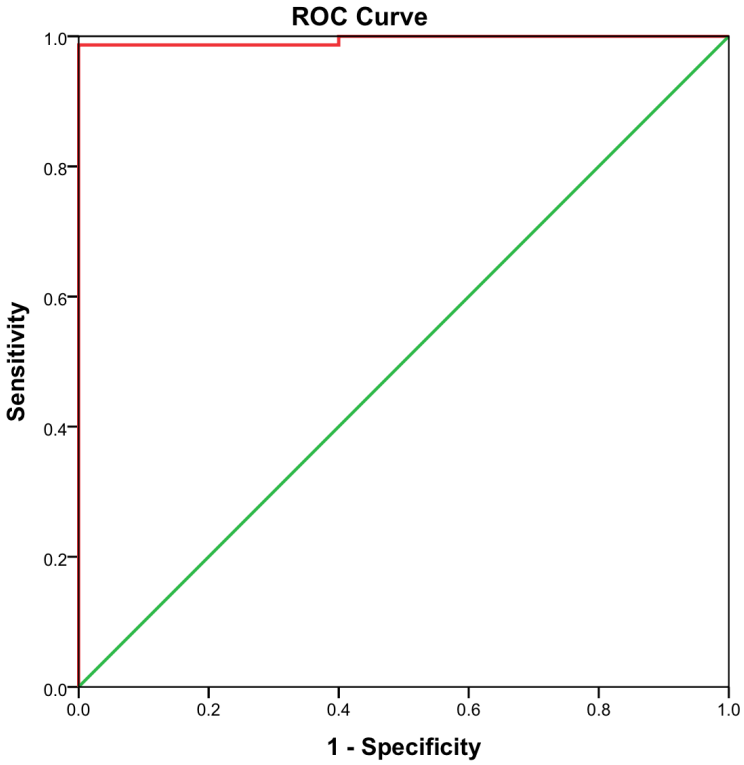
ROC CURVE FOR POSSUM PREDICTED SCORE FOR MORTALITY

Case Processing Summary

Cause of death	Valid N (listwise)
Positive[a]	149
Negative	5

Smaller values of the test result variable(s) indicate stronger evidence for a positive actual state.

a. The positive actual state is 0.



Area Under the Curve

Test Result Variable(s): POSSUM predicted mortality

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.995	.005	.000	.984	1.000

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

SENSITIVITY - - 98.70 %

SPECIFICITY - - 100 %

CHAPTER 5

DISCUSSION

DISCUSSION OF RESULTS

This prospective, observational and descriptive study was conducted among 154 purposively selected patients who had underwent midline laparotomy for elective or emergency causes in Department of General Surgery, Stanley Medical College and Government General Hospital. The study was carried out with a view to determine the validity of POSSUM scoring in predicting the morbidity and mortality of patients undergoing midline laparotomy. The standards of our institution compared to the general accepted level of morbidity and mortality was also analysed.

In our study, there were a total of 154 patients. Of these sixty five patients (42.2%) had underwent elective laparotomy while eight nine patients (57.8%) were taken up for laparotomy for emergent causes.

Age and Sex Distribution :

More than sixty percent of our patients were males, with a male : female ratio of 3 : 2. The patients ranged from thirteen years to ninety years. But the predominant age group involved was 40 - 60 years in the elective group while in the emergency group, there was no specific predominance with even distribution of patients. There were more number of patients in the younger age group (< 30 yrs)

in emergency group compared to elective - 22 vs 5. In total nearly thirty percent of patients belonged to the 40 - 50 age group, this being significant, due to more prevalence of comorbid factors in the older age group.

Risk Factors :

The POSSUM score includes the presence or absence of features of cardiac or respiratory problems. In our study, only one patient had cardiac risk in the elective group while five patients had cardiac risk in the emergency group. Respiratory signs were more prevalent with nine patients in elective group and eighteen patients in the emergency group, having them.

Vital Parameters :

The Vital parameters studied in POSSUM score include the systolic blood pressure (90 - 120 mm of Hg), Pulse rate (60 - 90 /min) and GCS (15). An analysis of these parameters showed that the elective group patients had stable vitals with all patients having a GCS of 15 with only three patients having tachycardia and fourteen patients with hypo/hypertension which can be due to age related changes. In the emergency group, as expected more than eighty percent of the patients had tachycardia with low GCS seen in as many as eleven patients, hypotension also being more prevalent with twenty seven percent having abnormal systolic blood

pressure.

Blood Investigations :

The blood investigations included in the study are Hemoglobin, Total Count, Urea and serum electrolytes. In the elective group, nearly all patients had these investigations with the normal range but in the emergency group, a significant number of patients had deranged parameters, with nearly forty percent having elevated total count and electrolyte abnormalties

Details of Procedure :

In the elective group, thirteen out of sixty five patients had underwent major surgery as per the POSSUM guidelines. All patients had only a single procedure with blood loss being less than 500 ml in more than seventy five percent of patients. Only one patient had peritoneal soiling in the form of local pus. Twenty seven patients were malignant patients with eleven of them having distant metastasis and the surgical procedure being purely palliative.

In the emergency group, only three patients had a major + surgery, with six patients having one or more repeat surgeries. Blood loss was also higher with seventeen patients having more than 1000 ml blood loss. Peritoneal soiling was also very common, with thirty seven patients having localised pus collections,

spillage of bowel contents seen in sixteen patients and hemoperitoneum in nine patients. Only seven of eighty nine patients had malignant disease.

Prevalence of Morbidity :

Twenty percent of elective patients had morbidity while more than fifty percent of emergency patients having morbidity. Wound related complications was the predominant cause of morbidity in patients undergoing emergency laparotomy while basal atelectasis and venous thrombosis more commonly seen in elective patients. Pulmonary complications were also more common in emergency group.

Prevalence of Mortality :

None of the elective patients died in the post operative period while five patients in the emergency laparotomy group died with three people due to Multi Organ Dysfunction, one due to sepsis and one due to SIRS.

Relevance of POSSUM Score for Morbidity & Mortality :

In elective patients, the expected to observed morbidity was similar, but significance couldn't be attributed as the prevalence of morbidity as such was low in that group. Among those who had post surgical complications, their POSSUM score was high, indicating a good specificity of the score.

In the emergency group, the correlation was significant with the predicted morbidity levels being the same as what was actually seen in the study. A graph showing the expected to observed ratio showed that the two lines were parallel and close to each other, indicating a significant level of correlation. Out of the 50 odd patients who had a morbidity predicted percentage of more than seventy, forty two patients developed post surgical complications indicating a high level of sensitivity and specificity for the score to predict morbidity

With regards to mortality, the low rates of mortality in the study precludes any meaningful analysis. Among the five patients who died, their POSSUM predicted mortality percentage was more than ninety in four of the cases and conversely out of the six patients who had a POSSUM score of more than ninety percent, four patients died. This again indicates a high level of sensitivity and specificity of the score to predict mortality.

Chi Square analysis of the significance of POSSUM score to predict morbidity and mortality among our study group patient showed a high level of significance < 0.001 for both mortality and morbidity.

A ROC curve for POSSUM predicted score for morbidity indicated a sensitivity of 98% and specificity of 100%, while for the predicted score for mortality had a sensitivity of 98.70% and specificity of 100%.

The statistical analysis shows highly reliable evidence that POSSUM score can be used to determine the percentage of risk for morbidity and mortality in patients undergoing laparotomy, especially in the emergency setting.

CONCLUSION

In today's era, where the patient's safety and proper management of patient is of utmost importance, it becomes only necessary to assess the expected outcome of the procedure performed. Recognizing patients who are at high risk to develop complications and who have high risk of mortality would prompt us to take necessary and timely action and aid us in the better management of the patient. An ideal scoring system should be applicable to a wide range of general surgical procedures, both elective and emergency and should allow the prediction of both morbidity and mortality with reasonable sensitivity and specificity. In the past numerous scoring systems like ASA and APACHE II have been used to predict both morbidity and mortality in surgical patients. These existing scoring systems are either too simple or too complex and do not meet the expectation as being readily applicable to all patients. POSSUM has been proved to be one of the best scoring systems that could predict the morbidity and mortality risk with reasonable accuracy. It has been validated by many authors around the world and has been a successful tool in surgical audit. It has been used by many authors in various surgical specialties with success, though it was found to slightly over predict morbidity and mortality.

POSSUM morbidity equation can reasonably predict morbidity in high risk groups whereas the sensitivity falls in elective conditions. Predictive value

improves when linear analysis is used and results improve dramatically when exponential analysis is applied.

POSSUM mortality equation over predicts mortality especially in low risk groups, while the predictive value improves significantly when exponential analysis is used.

Hence POSSUM scoring system has an undeniable advantage in our set up for better patient counseling, improving the surgical outcomes in both emergency and elective wards and for better management of limited resources and manpower.

LIMITATIONS

In spite of the numerous advantages that the POSSUM scoring system offers, there are few limitations inherent to the scoring system as well as to the study design.

A small sample size is a limitation in places where data availability and compilation is restricted. Especially when exponential analysis is known to yield better results with POSSUM.

Factors that are known to influence post operative complications such as co morbid illness, drug history, delay in transport to the treatment centre are not included in the score.

RECOMMENDATIONS

- In our set up, with availability of round the clock laboratory facilities, POSSUM can be implemented satisfactorily in emergency wards.
- An ideal scoring system can help in interpersonal as well as inter departmental analysis of surgical outcomes across various disciplines.
- An uniform guideline can be established for surgical audits with POSSUM scores.

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APPENDIX - I : ETHICAL COMMITTEE CLEAREANCE

INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Evaluation of POSSUM scoring system in patients undergoing laparomomy

Principal Investigator : Dr. Vijaya Laksmi

Designation : PG in MS (General Surgery)

Department : Department of General Surgery
Government Stanley Medical College,
Chennai-01

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 26.11.2014 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

K Vasantha
MEMBER SECRETARY,
IEC, SMC, CHENNAI

Appendix-II

EVALUATION OF POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING LAPAROTOMY

Investigator: Dr.G.VIJAYALAKSHMI, PG MS (General Surgery)

NAME : SL. NO:

AGE /SEX:

ADDRESS WITH CONTACT NUMBER:

IP NO:

DATE OF ADMISSION:

DATE OF SURGERY:

HISTORY OF PRESENTING ILLNESS:

PAST HISTORY:

Whether a known case of DM/Hypertension/Asthma/TB/epilepsy/cardiac illness

H/O SIMILAR EPISODES IN THE PAST, IF ANY:

CLINICAL EXAMINATION:

GENERAL EXAMINATION: TEMP: P.R: B.P: R.R

SYSTEMIC EXAMINATION:

CVS

RS

PER ABDOMEN:

CLINICAL DIAGNOSIS:

INVESTIGATIONS:

HEMATOLOGY

HB
PCV
RBC
TC
DC
PLT
ESR

RBS

B.UREA

S.CREAT

S.Na+

S.K+

S.Cl-

S.HCO3-

CHEST X RAY :

ABD X RAY:

USG ABD:

CT/CECT:

PATIENT CLINICAL COURSE:

PHYSIOLOGICAL SCORE

	1	2	4	8
AGE (years)	<60	61-70	>71	
Cardiac signs Chest radiography	No failure	Diuretic, Digoxin, anti-angina or hypertensive therapy	Peripheral edema, warfarin therapy, borderline cardiomegally	Raised JVP, cardiomegally
Respiratory history Chest radiography	No dyspnoea	Dyspnoea on exertion Mild CAOD	Limiting dyspnoea (one on flight) Moderate CAOD	Dyspnoea at rest (rate>30/ min) Fibrosis or consolidation
Blood Pressure (systolic) (mmHg)	110-130	131-170 100-109	>171 90-99	<89
Pulse (beats/min)	50-80	81-100 40-49	101-120	>121 <39
Glasgow coma scale	15	12-14	9-11	<8
Hemoglobin (g/ dl-l)	13-16	11.5-12.9 16.1-17.0	10.0-11.4 17.1-18.0	<9.9 >18.1
White cell count (x10^9/l)	4-10	10.1-20.0 3.1-4.0	>20.1 <3.0	
Urea (mEq/l)	<7.5	7.6-10.0	10.1-15.0	>15.1
Sodium (mEq/l)	>136	131-135	126-130	<125
Potassium (mEq/ l)	3.5-5.0	3.2-3.4 5.1-5.3	2.9-3.1 5.4-5.9	<2.8 >6.0
Electrocardiogra m	Normal		Atrial fibrillation (rate 60-90)	Any other abnormal rhythm or >5 ectopics/min Q Waves or ST/ T wave changes

OPERATIVE SCORE

	1	2	4	8
Operative severity	Minor	Moderate	Major	Major+
Multiple Procedures	1		2	>2
Total blood loss (ml)	<100	101-500	501-999	>1000
Peritoneal soiling	None	Minor (serous fluid)	Local pus	Free bowel content, pus or blood
Presence of Malignancy	None	Primary only	Nodal metastasis	Distant Metastases
Mode of surgery	Elective		Emergency resuscitation of >2h possible <24h after admission	Emergency (immediate) surgery <2h needed

OUTCOME OF TREATMENT:

The risk (R1) of morbidity and mortality (R2) were calculated for each patient according to the previously validated POSSUM equations as follows:

For morbidity:

$\text{Log}\ (R_2/(1-R_2) = -5.91 + (O.16 \text{ X physiological score}) + (0.19 \text{ X operative score})$

For mortality:

$\text{Log}\ (R_1/1-R_1) = -7.04 + (0.13 \text{ X physiological Score}) + (0.16 \text{ X operative score})$

EVALUATION OF POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING LAPAROTOMY

Investigator: Dr.G.VIJAYALAKSHMI, PG - MS (General Surgery)

Guide: Prof. Dr.VISHWANATHAN

PATIENT INFORMATION MODULE

You are being invited to be a subject in this study.

Before you participate in this study, I am giving you the following details about this trial, which includes the aims, methodology, intervention, possible side effects, if any and outcomes.

All patients who underwent midline laparotomy will be included in this study. A detailed clinical history will be taken following a standardized proforma. A detailed clinical examination will be made and relevant basic investigations will be done at the time of admission. Evaluation of POSSUM scoring system will be done. The results arising from this study will be analyzed and used for academic purposes. You will be given clear instructions at every step and you are free to ask/ clarify any doubts. Your identity will remain confidential. You are free to withdraw from this trial at any point of time, without any prior notice &/ or without any medical or legal implications.

I request you to volunteer for this study.

Thanking You,

Investigator's Sign — Patient's Sign

(Dr.G.VIJAYALAKSHMI) — (Name:)

ஆராய்ச்சி தகவல் தாள்

ஆராய்ச்சி எண் : உள் நோயாளி எண் :

பங்கேற்பாளரின் பெயர் : வயது : ஆண் / பெண் :

சென்னை ஸ்டான்லி பொது மருத்துவமனையில் வயிற்றுக்கான அறுவை சிகிச்சை செய்து கொள்பவர்களுக்கு POSSUM மதிப்பெண்களின் ஒப்புதல் தன்மை பற்றிய ஆராய்ச்சி நடைபெற உள்ளது. இந்த ஆராய்ச்சியில் தாங்கள் பங்கு பெற நாங்கள் விரும்புகிறோம். இது தங்களின் முதன்மை சிகிச்சையை எவ்விதத்திலும் பாதிக்காது. இந்த ஆராய்ச்சியின் முடிவுகள் நேர்மறை முடிவுகளாக இருப்பின் அது பின் வரும் நோயாளிகளுக்கு பயனுள்ளதாகவும் இருக்கும்.

இந்த ஆராய்ச்சியினால் தங்களின் நோயின் ஆய்வறிகையோ அல்லது சிகிச்சையோ பாதிப்பு ஏற்படாது என்று தெரிவித்து கொள்கிறோம். முடிவுகளை அல்லது கருத்துகளை வெளியிடும்போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது பெயரோ அல்லது அடையாளங்களோ வெளியிட மாட்டோம் என்பதையும் தெரிவித்து கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களது விருப்பத்தின் பேரில் மட்டும் தான் மேலும் இந்த ஆராய்ச்சியின் முடிவுகள் தங்களுக்கு அறிவிக்கப்படும் என்றும் தெரிவித்து கொள்கிறோம். மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியிலிருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்து கொள்கிறோம்.

ஆராய்ச்சியாளர் கையொப்பம் பங்கேற்பாளர் கையொப்பம்

நாள் :

இடம் :

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சியின் தலைப்பு : ஸ்டான்லி பொது மருத்துவமனையில் வயிற்றுக்கான அறுவை சிகிச்சை செய்து கொள்பவர்களுக்கு POSSUM மதிப்பெண்களின் ஒப்புதல் தன்மை

பங்குகொள்வரின் பெயர் :

ஆராய்ச்சி செய்பவரின் பெயர் : விஜயலக்ஷ்மி

இடம் : அரசு பொது மருத்துவமனை, சென்னை – 60000

_____ எனும் நான், எனக்கு கொடுத்துள்ள தகவல் தாளை படித்து புரிந்து கொண்டேன். நான் பதினெட்டு வயதை கடந்துள்ளதால், என்னுடைய சுயநினைவுடனும், முழு சுகந்திரதுடனும், இந்த ஆராய்ச்சியில் என்னை சேர்த்துக்கொள்ள சம்மதிக்கிறேன்.

நான், எனக்கு கொடுத்துள்ள தகவல் தாளை படித்து புரிந்து கொண்டேன்.

எனக்கு இந்த ஆராய்ச்சியின் ஒப்புதல் படிவம் விளக்க பட்டுள்ளது.

எனக்கு இந்த ஆராய்ச்சியின் நோக்கமும், விவரங்களும் விளக்கப்பட்டது.

எனக்கு என்னுடைய உரிமைகள் பற்றி விளக்கப்பட்டது.

இந்த ஆராய்ச்சியில் இருந்து நான் என் நேரமும் பின் வாங்கலாம் என்றும், அதனால் எந்த பின் விளைவும் ஏற்படாது என்று புரிந்து கொண்டேன்.

என்னை பற்றி எந்த தகவலும், அடையாளங்களும் வெளியிடப்பட மாட்டது என்பதையும் புரிந்து கொண்டேன்.

என்னுடைய முழு சுகந்திரதுடனும் இந்த ஆராய்ச்சியில் சேர்த்து கொள்ள சம்மதிக்கிறேன்.

பங்கேற்பாளர் கையொப்பம் ஆராய்ச்சியாளர் கையொப்பம்

நாள் :

இடம் :

INFORMED CONSENT

Name: Age/ Sex: IP:

I herewith declare that I have been explained in a language fully understood by me regarding the purpose of this study, methodology, proposed intervention, plausible side effects, if any and sequelae.

I have been given an opportunity to discuss my doubts and I have received the appropriate explanation.

I understand that my participation in this study is completely voluntary and that I am free to withdraw from this study at anytime without any prior notice &/ or without having my medical or legal rights affected.

I permit the author and the research team full access to all my records at any point, even if I have withdrawn from the study. However my identity will not be revealed to any third party or publication.

I herewith permit the author and the research team to use the results and conclusions arising from this study for any academic purpose, including but not limited to dissertation/ thesis or publication or presentation in any level.

Therefore, in my full conscience, I give consent to be included in the study and to undergo any investigation or any intervention therein.

Patient's Sign Investigator's Sign

(Dr.G.VIJAYALAKSHMI)

Appendix – III

Statistical formula

A. Sample size:

To determine the sample size, this formula was used; $n = \frac{z^2 pq}{d^2}$

Where,

n = the desired sample size,

z = the standard normal deviate, usually set at 1.96 at 5% level,

which corresponds to 95% confidence level,

p = proportion of population, q

= 1- p

d = the degree of accuracy level considered as 5.0 %,

which assumes 0.05

If population size, N < 10,000 than the required sample size is very much smaller which was calculated by the following formula –

$$n_f = \frac{n}{1 + \frac{n}{N}}$$

Where,

n_f = the desired sample size, when population size, N < 10,000

n = the desired sample size, when population size, N > 10,000 N

= the roughly estimated population size.

B. Arrithmatic mean, $X = \frac{\sum fx}{N}$ (for grouped data)

C. Standard deviation , $SD = \sqrt{\overline{\sum (X- X)^2}}$

('O' indicates observed value and 'E' indicates expected value)

D. $$Z = \frac{P_1 - P_2}{\sqrt{\left[\frac{P_1 Q_1}{N_1} + \frac{P_2 Q_2}{N_2}\right]}}$$

P_1 indicates proportion in first group

P_2 indicates proportion in second group

$Q_1 = 100 - P_1$

$Q_2 = 100 - P_2$

N_1 indicates sample size of first group

N_2 indicates sample size of second group.

E. $$SD = \sqrt{\frac{\sum(X - \bar{X})}{(N-1)}}$$

Here, $\bar{X}$ indicates mean value
X indicates individual value
N indicates sample

The collected data was analysed with SPSS 16.0 version.To describe about the data descriptive statistics frequency analysis, percentage analysis were used for

categorical variables and for continuous variables the mean and S.D were used. To find the significance difference between the bivariate samples in the Independent groups (Elective & Emergency) Unpaired t-test was used.Receiver operating characteristic (ROC) curves were drawn to find out area under the curve (AUC) for differentiation of two groups and cut−off value was calculated so as to achieve the highest average sensitivity and specificity.The logistic regression was used to fit the model. The observed and expected morbidity rates for possum was compared with linear by linear association of chi-square test.To find the significance in the categorical data Chi-Square test was test. In all the above statistical tools the probability value .05 is considered as significant level.

APPENDIX IV - - PLAGIARISM

APPENDIX V — MASTER CHART

S. No.	Name	Age	Sex	IP No.	Diagnosis	Procedure	Cardiac History	Resp history	SBP	PR	GCS	Hb	TC	Urea	Na+	K+	ECG	Operative Severity	Multiple procedures	Total blood loss	Perineal soiling	Malignancy	Mode of Surg	Phys Sev Score	Oper Sev Score	POSSUM - Morbidity	POSSUM - Mortality	Post op Comp	Cause of Death
1	kosalai	52	F	1516290	duodenal perforation	omental patch closure	NF	ND	140	90	15	9.8	10,400	9	135	3.4	N	major	1	200	LP	-	Em	25	16	75.60%	22.60%	WD	-
2	kesavalurajа	54	M	1516162	Ca head of pancreas	whipple's procedure	NF	ND	100	80	15	10.2	8,600	11	133	4.2	N	major +	1	800	-	NDS	Ele	21	19	74.30%	21.90%	-	-
3	lakshmi	38	F	1517158	blunt abdomen injury	ileal resection/ ileostomy	NF	ND	90	128	15	10.6	6,800	7	145	4.7	N	major	2	3,500	BC	-	Em	25	29	97.30%	17.10%	WD	-
4	bhagavathi	24	F	1526178	ileal perforation	primary closure	NF	ND	110	132	15	11	13,800	8.3	139	4.3	N	major	1	250	LP	-	Em	24	16	72.50%	20.40%	WI	-
5	sundaram	60	M	1678345	Ca rectum	low anterior resection	NF	DE	150	68	15	11.8	5,400	7.8	140	3.3	N	major +	1	500	-	Prim	Ele	17	15	41.60%	10.10%	AL	-
6	veni	35	F	1813452	mesentric cyst	resection anastomosis	NF	ND	130	72	15	12	4,800	7	138	3.8	N	major	1	200	-	-	Ele	13	10	12.70%	2.30%	-	-
7	prasath	40	M	1528970	pseudocyst pancreas	cystogastrostomy	NF	ND	132	98	15	13	23,500	11	130	2.9	N	maior	1	300	-	-	Ele	26	10	53.70%	11.30%	At	-
8	dharini	16	F	1617560	urachal cyst	cyst excision	NF	ND	130	88	15	12	6,500	6	137	3.7	N	major	1	50	-	-	Ele	14	9	12.30%	2.20%	-	-
9	karthigai	65	F	1513890	ileal stricture	strictoroplasty	NF	LD	140	72	15	11	21,000	11	133	3.8	N	major	1	200	-	-	Ele	27	10	57.70%	12.70%	At	-
10	dharan	22	M	1789654	duodenal perforation	omental patch closure	NF	ND	130	98	15	13.7	11,000	6.5	139	4	N	major	1	100	LP	-	Em	14	16	34.80%	6.50%	-	-
11	durai	32	M	1519809	penetrating injury abdomen	jejunal resection/ ileostomy	NF	ND	90	124	13	13	9,700	12	129	4.4	N	major	3	2,500	BC	-	Em	29	37	99.70%	93.40%	WD	-
12	sarvesh	18	M	1817564	appendicular perforation	open appendicectomy	NF	ND	100	96	15	12	11,800	6	139	4.5	N	maior	1	150	LP	-	Em	16	15	37.80%	7.20%	-	-
13	velayudham	82	M	1514238	sigmoid volvulus	sigmoidectomy/end colostomy	Dig	DE	110	99	15	13.2	9,800	11.3	140	3.3	NS	maior	1	350	-	-	Em	22	13	52.00%	10.90%	-	-
14	kathiresan	75	M	1515342	malignant gastric perforation	perforation closureJ	NF	DR	94	104	15	8.6	5,600	12	133	3.2	NS	maior	1	200	LP	DS	Em	40	27	99.60%	92.30%	-	SIRS
15	kameela	52	F	1517687	ileal perforation	primary closure	NF	ND	110	106	15	9.2	9,000	8	135	4.1	N	major	1	300	LP	-	Em	24	16	72.50%	20.40%	-	-
16	rajendran	49	M	1615134	Ca colon	left hemicolectomy	NF	ND	120	72	15	10.8	6,700	6	138	4.2	N	major	1	500	-	NDS	Ele	15	13	26.10%	4.70%	-	-
17	velusamy	68	M	1519876	Ca rectum	abdominoperineal resection	NF	DE	110	68	15	11.9	5,500	8	129	3.1	N	major+	1	650	-	-	Ele	22	16	65.70%	16.50%	DVT	-
18	sivasankaran	55	M	1876434	periampullary carcinoma	whipple's procedure	NF	ND	120	72	15	10.6	6,700	6	138	5.2	N	major+	1	700	-	NDS	Ele	16	16	42.30%	8.30%	-	-
19	albert	42	M	1618788	liver abscess	open drainage	NF	ND	110	88	15	12	23,400	7.2	139	5	N	major	1	200	-	-	Ele	17	10	31.60%	3.80%	-	-
20	vasugi	39	F	1513776	pelvic abscess	open drainage	NF	ND	110	96	15	11.6	25,000	7	140	4.8	N	major	1	250	LP	-	Em	17	16	46.30%	9.40%	WI	-
21	fathima	25	F	1716554	appendicular perforation	open appendicectomy	NF	ND	120	108	15	11	13,900	6.5	142	4.7	N	major	1	300	LP	-	Em	19	16	54.20%	11.80%	-	-
22	mathivanan	55	M	1516454	acute intestinal obstruction	resection anastomosis	NF	DE	90	96	15	8.8	10,800	7.8	141	3.3	N	major	1	500	-	-	Em	27	13	70.70%	19.00%	AL	-
23	kamaal	45	M	1515443	ileal perforation	primary closure	NF	ND	110	98	15	10.9	21,900	6	138	3.7	N	major	1	450	LP	-	Em	19	16	54.20%	11.80%	-	-
24	udhayadasan	56	M	1645343	SMA thrombosis	resection anastomosis	Diu	DE	94	102	15	11.2	5,300	12	125	2.8	NS	major	1	1,200	-	-	Em	40	23	99.20%	86.30%	-	MODS
25	shameem	45	F	1518787	multiple ileal strictures	resection anastomosis	NF	ND	110	86	15	10.8	22,400	6.5	138	4.2	N	major	1	450	-	-	Ele	19	10	27.50%	4.90%	-	-
26	saran	27	M	1517676	duodenal perforation	omental patch closure	NF	ND	100	98	15	12	15,600	5.5	142	4.6	N	major	1	150	LP	-	Em	16	16	42.30%	8.30%	-	-
27	vaamanan	32	M	1514343	retroperitoneal dermoid	cyst excision	NF	ND	120	75	15	13.2	5,600	6	143	4.9	N	major	1	100	-	-	Ele	12	9	9.30%	1.70%	-	-
28	vanaja	44	F	1615652	adnexal cyat	TAH with BSO	NF	ND	124	71	15	11.6	7,200	5.8	139	4	N	major	1	350	-	-	Ele	13	10	9.70%	2.30%	-	-
29	shakuth	37	M	1517678	blunt abdomen injury	splenectomy	NF	ND	84	112	14	10.8	4,600	9	135	5.8	N	major	1	2,700	HP	-	Em	31	26	98.20%	76.00%	PE	-
30	shahul hameed	42	M	1515434	subacute bowel obstruction	adhesiolysis	NF	ND	110	89	15	13.2	5,600	5.6	142	4.5	N	major	1	150	-	-	Ele	13	10	12.70%	2.30%	-	-
31	vasantha	38	F	1897887	traumatic gastric perforation	omental patch closure	NF	ND	100	98	15	11.6	7,800	6.2	138	4.7	N	major	1	400	LP	-	Em	15	16	38.50%	7.40%	-	-
32	maayan	47	M	1817676	psedocyst pancreas	cystogastrostomy	NF	ND	110	88	15	12.8	22,600	8	142	5	N	major	1	350	-	-	Ele	18	10	24.40%	4.30%	-	-
33	kabilar	58	M	1716588	Ca body and tail of pancreas	palliative triple bypass	NF	LD	110	75	15	11.9	7,600	8.6	140	4.6	N	major	1	650	-	DS	Ele	17	19	60.30%	14.30%	At	-
34	giriija	47	F	1617565	Ca anal canal	diversion colostomy	NF	ND	124	87	15	10.8	8,700	6.5	143	4.4	N	major	1	500	-	NDS	Ele	16	13	29.30%	5.30%	-	-
35	madhavi	38	F	1617877	blunt abdomen injury	mesentric tear - primary repair	NF	ND	96	122	15	11.4	5,700	5.5	144	4.2	N	major	1	1,400	HP	-	Em	25	26	95.40%	59.10%	WI	-
36	kavish	26	M	1816565	chylolymphatic cyst	resection anastomosis	NF	ND	130	72	15	13	4,600	5	140	4	N	major	1	200	-	-	Ele	12	10	11.00%	2.00%	-	-
37	revathi	39	F	1816567	blunt abdomen injury	hepatic laceration - 1*repair	NF	ND	114	102	15	12.6	5,200	6.2	133	3.6	N	major	1	1800	HP	-	Em	17	26	85.20%	33.80%	Pne	-
38	raialakshmi	34	F	1819898	appendicular abscess	open appendicectomy	NF	ND	110	112	15	11.8	23,000	7	138	4.8	N	major	1	400	LP	-	Em	19	16	54.20%	11.80%	WI	-
39	agilam	78	F	1817670	sigmoid perforation	diversion colostomy	NF	LD	102	106	15	10.6	27,800	10	140	5.6	NS	major	1	600	BC	-	Em	32	22	96.70%	65.50%	WD	-
40	subhash	42	F	1917678	penetrating injury abdomen	ileal resection/ ileostomy	NF	ND	90	110	14	11.9	6,700	5.7	142	6	N	major	2	1,600	BC	-	Em	23	33	98.30%	77.40%	WD	-
41	fazil	54	M	1518960	aortic dissection	open repair	NF	DE	84	116	15	12.4	5,800	6	148	5.3	NS	major +	1	2,200	-	-	Em	24	27	95.50%	59.90%	PE	-
42	mahendran	44	M	1516458	diahraematic rupture	primary closure	NF	DR	90	104	15	12.6	6,500	7	139	5.5	NS	major	1	1,200	HP	-	Em	29	30	98.80%	82.20%	At	-
43	venkattamma	48	F	1519880	ileal perforation	primary closure	NF	ND	110	114	15	10.8	22,000	6.2	142	5.3	N	major	1	400	LP	-	Em	22	16	65.70%	16.50%	-	-
44	rajan	52	M	1617566	Ca stomach	distal radical gastrectomy	NF	ND	120	82	15	11.6	6,800	6.4	138	4.2	N	major +	1	700	-	NDS	Ele	14	19	48.50%	10.20%	-	-
45	madhanraj	44	M	1514890	chronic calcific pancreatitis	Frey's procedure	NF	ND	138	76	15	12	7,400	5.5	133	5.8	N	major	1	800	-	-	Ele	18	12	32.10%	5.80%	-	-
46	graham	29	M	1615677	blunt abdomen injury	splenectomy	NF	ND	104	122	15	11.8	8,000	7	136	3.8	N	major	1	1200	HP	-	Em	21	26	91.60%	46.30%	Pne	-
47	kuppan	65	M	1514348	appendiceal carcinoid	right hemicolectomy	NF	ND	110	75	15	12	5,800	7.2	140	4.2	N	major	1	500	-	Prim	Ele	14	11	17.10%	3.00%	-	-
48	preethi	38	F	1511143	sealed ileal perforation	laparotomy and peritoneal wash	NF	ND	122	108	15	11.4	23,500	8	139	5.4	N	major	1	300	BC	-	Em	25	20	86.90%	35.70%	-	-
49	munusamy	54	M	1514342	choledochoduodenal fistula	cholecystectomy/CBD exploration	NF	ND	130	82	15	13.8	5,800	6	140	5	N	major	1	650	-	-	Ele	13	12	17.50%	3.10%	-	-
50	rasheed	42	M	1516676	duodenal perforation	omental patch closure	NF	ND	110	98	15	13	22,000	7.5	143	4.5	N	major	1	400	LP	-	Em	16	16	42.30%	8.30%	-	-

51	mariyappan	36	M	1518990	Ca stomach	distal radical gastrectomy	NF	ND	110	82	15	12	6,500	5	140	4	N	major +	1	300	-	NDS	Ele	14	17	39.20%	7.60%	-	-
52	rajini	25	M	1654787	penetrating injury abdomen	ileal resection/ ileostomy	NF	ND	130	110	12	14	9000	10	138	3.9	N	major	2	350	BC	-	Em	17	27	87.40%	37.50%	WI	-
53	kolanji	65	F	1514343	Ca colon	left hemicolectomy	NF	DE	130	98	15	10	5,500	12	144	4.2	N	major	1	200	-	DS	Em	21	20	77.70%	24.80%	-	-
54	saroja	50	F	1789787	Ca rectum	abdominoperineal resection	NF	ND	90	74	15	12	6,200	5.8	139	3.3	N	major +	1	250	-	Prim	Ele	17	15	41.60%	8.10%	-	-
55	devaraj	55	M	1989078	ruptured gall bladder	open cholecystectomy	NF	ND	110	102	15	13	12,800	9	141	3.5	N	major	1	200	LP	-	Em	17	16	46.30%	9.40%	ARDS	-
56	narasaiah	60	M	1567556	Ca stomach	subtotal gastrectomy	NF	ND	110	76	15	10	5,500	6	133	3.2	N	major	1	220	-	NDS	Ele	17	13	32.70%	6.00%	-	-
57	pushpalatha	42	F	1513456	sigmoid perforation	primary closure/ colostomy	NF	ND	120	80	15	10.2	9,800	7	140	3.9	N	major	1	300	LP	-	Em	15	16	38.50%	7.40%	At	-
58	jayapal	45	M	1616567	acute intestinal obstruction	resection anastomosis	NF	ND	100	97	15	13	11,800	11	137	3.3	N	major	1	350	-	-	Em	19	10	27.50%	4.90%	-	-
59	manohar	66	M	1876880	Ca colon with obstruction	right hemicolectomy/ileostomy	NF	ND	90	104	12	10.2	13,300	10	133	3.5	N	major	1	300	-	NDS	Em	26	16	78.40%	25.00%	WD	-
60	dhanasekar	52	M	1916565	ileal perforation	primary closure	NF	ND	90	110	14	12	5,800	6	135	3.9	NS	major	1	350	LP	-	Em	21	16	62.00%	14.80%	-	-
61	raheem	29	M	1514383	duodenal perforation	omental patch closure	NF	ND	100	112	15	13	6,900	8	134	4.2	N	major	1	150	LP	-	Em	18	16	50.20%	10.50%	-	-
62	krishnamoorthy	51	M	1512032	Ca colon with obstruction	extended right hemicolectomy	NF	ND	110	104	15	14	5,600	10	139	4.4	N	major	1	200	-	Prim	Em	16	14	33.40%	6.20%	-	-
63	ambikapathy	27	M	1534454	ileal perforation	primary closure	NF	ND	90	112	15	13	12,500	9	133	5.2	N	major	1	200	LP	-	Em	22	16	65.70%	16.50%	UTI	-
64	sakkarapani	80	M	1616564	acute intestinal obstruction	resection anastomosis	NF	DE	94	104	15	11	8,700	12	140	5.1	N	major	1	150	-	-	Em	29	13	76.90%	23.30%	-	-
65	md. Nosha	90	M	1810789	Ca phaynx	feeding jejunostomy	NF	DE	100	77	15	10	6,800	24	144	3.3	N	major	1	50	-	DS	Ele	28	16	83.30%	30.20%	-	-
66	karim	82	M	1517980	Ca esophagus	feeding jejunostomy	NF	ND	110	78	15	11.2	5,400	22	140	3.1	N	major	1	100	-	DS	Ele	28	16	83.30%	30.20%	Pne	-
67	prathap	16	M	1518790	appendicular perforation	open appendicectomy	NF	ND	100	102	15	13.6	15,900	10	135	4.1	N	major	1	150	LP	-	Em	19	16	54.20%	11.80%	Pne	-
68	kanimozhi	32	F	1513465	torsion ovarian cyst	oophorectomy	NF	ND	140	96	15	11.4	8,800	11	133	3.6	N	major	1	200	-	-	Em	21	13	48.00%	9.70%	-	-
69	kanniyamma	55	F	1619089	ca ovary with bowel mets	staging laparotomy/stricturoplasty	NF	ND	150	89	15	10.6	5,600	15	140	4.2	N	major	1	250	-	DS	Ele	20	17	62.70%	15.20%	-	-
70	vasu	33	M	1617854	ileal perforation	primary closure	NF	ND	110	95	15	14	6,900	9	138	3.9	N	major	1	100	LP	-	Em	14	15	30.60%	5.60%	-	-
71	kalyani	45	F	1413234	urachal cyst	cyst excision	NF	ND	120	78	15	12	5,800	6	138	4.1	N	major	1	150	-	-	Ele	13	10	12.70%	2.30%	-	-
72	selvi	36	F	1909876	mesentric cyst	cyst excision	NF	ND	110	76	15	13.6	6,600	8	137	3.9	N	major	1	150	-	-	Ele	13	10	12.70%	2.30%	-	-
73	perumal	55	M	1918097	obstructed incisional hernia	resection anastomosis	NF	ND	130	87	15	14	7,800	15	133	3.4	N	major	1	150	-	-	Em	18	13	36.40%	6.80%	-	-
74	vaaruni	44	F	1517878	appendiclar perforation	open appendicectomy	NF	ND	140	96	15	12	10,600	7	135	3.5	N	major	1	100	LP	-	Em	16	16	42.30%	8.30%	WI	-
75	madhan	29	M	1510890	duodenal perforation	omental patch closure	NF	ND	120	90	15	12	8,800	6	133	4	NS	major	1	200	LP	-	Em	15	16	38.50%	7.40%	-	-
76	bavani	13	F	1512390	blunt injury abdomen	transverse loop colostomy	NF	ND	90	106	15	11	13,600	11	139	4.4	N	major	1	400	BC	-	Em	25	20	86.90%	35.70%	WD	-
77	gandhi	45	M	1417890	paraduodenal hernia	primary repair of recess	NF	ND	100	94	15	12	9,900	12	140	3.7	N	major	1	200	-	-	Em	18	13	36.40%	6.80%	-	-
78	karuppaiah	70	M	1518999	acute intestinal obstruction	resection anastomosis	NF	DR	160	104	14	9.8	7,800	15	134	3.2	NS	major	1	150	-	-	Em	37	13	92.30%	46.30%	ARDS	-
79	neelakandan	55	M	1517443	sigmoid volvulus	sigmoidectomy/end colostomy	NF	ND	90	98	15	10	6,600	11	138	3.8	NS	major	1	200	-	-	Em	22	13	52.00%	10.90%	-	-
80	robin	16	M	1510990	blunt injury abdomen	splenectomy	NF	ND	96	110	15	12	5,400	8	135	4.3	N	major	1	300	HP	-	Em	21	20	77.70%	24.80%	WI	-
81	parudhi	24	M	1615644	ileal perforation	primary closure	NF	ND	110	98	15	13	10,200	9	134	3.9	N	major	1	200	-	-	Em	16	13	29.30%	5.30%	-	-
82	kathir	23	M	1819800	umbilical sinus	sinus tract excision	NF	ND	120	77	15	12	6,700	7	136	3.8	N	major	1	50	-	-	Ele	13	9	10.70%	2.00%	-	-
83	madhanagopal	56	M	1810090	Ca stomach	distal radical gastrectomy	NF	ND	110	72	15	11	4,600	8	140	4.1	N	major +	1	200	-	NDS	Ele	16	19	47.00%	9.60%	-	-
84	ansi	45	F	1810054	liver abscess	open drainage	NF	ND	140	69	15	13	11,600	7	142	3.8	N	major	1	150	-	-	Ele	14	10	14.60%	2.60%	-	-
85	kamaal	65	M	1619880	ileal stricture	stricturoplasty	Diu	DE	160	72	15	13	9,800	11	138	3.9	N	major	1	200	-	-	Ele	19	10	27.50%	4.90%	DVT	-
86	ramesh	49	M	1514990	multiple ileal perforation	resection anastomosis	PE	DR	150	88	15	11	13,700	12	140	4.6	N	major	1	300	BC	-	Em	31	20	94.50%	54.70%	AL	-
87	aarumugam	45	M	1514446	caecal gangrene	limited resection/ileostomy	NF	ND	130	94	15	13	12,800	9	139	3.3	N	major	1	400	-	-	Em	16	13	29.30%	5.30%	-	-
88	malliga	55	F	1519908	ovarian dermoid cyst	cyst excision	NF	ND	130	81	15	11.6	5,600	7	135	3.6	N	major	1	250	-	-	Ele	14	10	14.60%	2.60%	-	-
89	velu	72	M	1615589	Ca colon	left hemicolectomy	NF	LD	110	78	15	12	8,800	9	133	4.1	N	major	1	200	-	NDS	Ele	21	13	48.00%	9.70%	-	-
90	barathi	55	M	1718890	hepatic hyadatid	primary resection	NF	DE	110	84	15	10.4	12,700	7	136	3.9	N	major	1	250	-	-	Ele	18	10	24.40%	4.30%	-	-
91	mani	29	M	1817790	duodenal perforation	omental patch closure	NF	ND	130	91	15	14	9,800	8	138	4.2	N	major	1	50	LP	-	Em	14	15	30.60%	5.60%	-	-
92	kavilaya	19	F	1819954	appendicular perforation	open appendicectomy	NF	ND	130	94	15	11	7,800	6	140	3.5	N	major	1	200	LP	-	Em	16	16	42.30%	8.30%	-	-
93	raju	33	M	1814477	bleeding gastric ulcer	ligation of bleeding vessel	NF	ND	140	98	15	12	8,800	7	139	3.8	N	major	1	500	-	-	Em	15	13	26.10%	4.70%	-	-
94	ashok	40	M	1918834	ileal perforation	primary closure	NF	ND	130	90	15	13	12,800	10	138	3.9	N	major	1	350	LP	-	Em	15	16	38.50%	7.40%	-	-
95	anitha	36	F	1816690	ruptured ectopic	salpingoopherectomy	NF	ND	90	104	15	9.6	5,500	9	133	4	N	major	1	750	HP	-	Em	27	22	93.00%	49.80%	WD	-
96	kodeeswaran	42	M	1817745	obstructed umbilical hernia	primary repair	NF	ND	130	93	15	15	6,600	10	138	4.2	N	major	1	200	-	-	Em	14	13	23.10%	4.10%	-	-
97	vedha	32	F	1527780	pelvic fracture/HP	repair of mesentric tear	NF	ND	80	100	12	8	5,500	10	133	4.6	N	major	2	1,450	HP	-	Em	30	29	98.80%	81.80%	At	-
98	kannan	82	M	1537752	SMA thrombosis	resection anastomosis	CCF	DR	88	98	15	11	4,600	11	135	4.2	ST	major	1	1,200	-	-	Em	51	23	99.90%	96.30%	-	MODS
99	selina	18	F	1518890	enterogenous cyst	resection anastomosis	NF	ND	110	88	15	12	9,800	7	133	4.1	N	major	1	150	-	-	Ele	15	10	16.70%	3.00%	-	-
100	sadaam	42	M	1618803	ileal stricture	stricturoplasty	NF	ND	120	72	15	13	8,600	6	139	3.9	N	major	1	100	-	-	Ele	12	9	9.30%	1.70%	-	-
101	neelima	56	F	1816678	Ca ovary	staging laparotomy	NF	DE	110	88	15	9	7,600	8	140	3.7	N	major	1	100	-	DS	Ele	22	16	65.70%	16.50%	-	-
102	venu	44	M	1817660	appendiceal carcinoid	right hemicolectomy	NF	ND	130	84	15	12	5,600	6	138	3.8	N	major	1	200	-	-	Ele	14	10	14.60%	2.60%	-	-
103	damodhar	32	M	1916560	ileal perforation	primary closure	NF	ND	110	92	15	13.6	8,700	5	142	3.6	N	major	1	150	LP	-	Em	13	16	31.20%	5.80%	-	-
104	vasanth	18	M	1519908	appendicular perforation	open appendicectomy	NF	ND	130	98	15	14	10,200	7	141	3.9	N	major	1	200	LP	-	Em	14	16	34.80%	6.50%	UTI	-

105	maheshwari	24	F	1514489	appendicular mass	open appendicectomy	NF	ND	130	72	15	12	11,200	6	138	4.2	N	major	1	100	LP	-	Ele	14	13	23.10%	4.10%	WD	-
106	lakshmi	75	F	1590871	Ca anal canal	diversion colostomy	NF	ND	140	78	15	10	8,700	9	140	3.9	N	major	1	150	-	DS	Ele	20	17	62.70%	15.20%	-	-
107	lurthusamy	60	M	1613350	Ca stomach	distal radical gastrectomy	NF	ND	120	88	15	11.6	5,400	8	136	3.8	N	major +	1	200	-	NDS	Ele	15	17	43.00%	8.50%	-	-
108	chandra	60	F	1988067	Ca head of pancreas	whipple's procedure	NF	ND	110	73	15	11	4,900	7	135	4.1	N	major +	1	250	-	Prim	Ele	16	15	37.80%	7.20%	ARDS	-
109	deivanaiammal	85	F	1817760	Ca colon	left hemicolectomy	NF	ND	110	72	15	10.9	6,600	10	133	3.4	N	major	1	300	-	NDS	Em	21	16	62.00%	14.80%	-	-
110	janarthanan	16	M	1716609	subacute intestinal obstruction	adhesiolysis	NF	ND	110	84	15	11.6	6,200	7	141	4.2	N	major	1	300	-	-	Em	14	13	23.10%	4.10%	-	-
111	kaliyamoorthy	40	M	1322670	blunt injury abdomen	jejunal resection/ ileostomy	NF	ND	120	92	14	13	7,200	6	136	3.9	N	major	1	1200	BC	-	Em	14	20	78.10%	25.70%	AKI	-
112	pandiyarajan	48	M	1221567	duodenal perforation	omental patch closure	NF	ND	110	84	15	12.6	13,000	11	134	4	N	major	1	300	LP	-	Em	19	16	54.20%	11.80%	-	-
113	shanthi	45	F	1219980	adnexal tumour	TAH with BSO	NF	ND	120	98	15	8.5	12,000	10	132	3.9	N	major	1	600	-	-	Ele	23	12	51.20%	10.60%	-	-
114	sakunthala	40	F	1517769	duodenal perforation	omental patch closure	NF	ND	136	102	15	7.4	13,800	11	130	5.4	N	major	1	200	LP	-	Em	33	16	91.80%	45.30%	WD	-
115	varadhan	54	M	1518890	choledocholithiasis	cholecystectomy/CBD exploration	NF	ND	140	74	15	12.8	6,900	6.4	136	4.8	N	major	1	350	-	-	Ele	14	10	14.60%	2.60%	-	-
116	kathirvel	52	M	1716690	abdominal aortic aneurysm	open repair	NF	DE	180	88	15	13.4	5,800	7	148	5.3	ST	major +	1	1,600	-	-	Em	25	27	96.20%	62.90%	AKI	-
117	kaasim	34	M	1615589	ileal perforation	primary closure	NF	ND	136	99	15	12.5	24,000	6	137	5.2	N	major	1	400	LP	-	Em	19	16	54.20%	11.80%	-	-
118	panimalar	44	F	1715568	ruptured liver abscess	open drainage	NF	Con	140	110	15	12.2	19,000	8	142	5.1	N	major	1	350	LP	-	Em	27	16	81.00%	27.50%	Pne	-
119	gopalan	62	M	1615578	periampullary carcinoma	whipple's procedure	NF	ND	138	82	15	10.8	6,700	6.5	130	4.2	N	major +	1	400	-	Prim	Ele	21	15	57.40%	12.90%	-	-
120	vaanjilingam	34	M	1513634	chronic calcific pancreatitis	Frey's procedure	NF	ND	142	76	15	11	8,700	6	137	4	N	major +	1	650	-	-	Ele	16	16	42.30%	8.30%	-	-
121	sheerin	21	F	1519008	appendicular perforation	open appendicectomy	NF	ND	110	114	15	12.6	18,500	5.2	140	3.9	N	major	1	200	LP	-	Em	17	16	46.30%	9.40%	-	-
122	ravannamma	52	F	1518009	acute intestinal obstruction	resection/ileostomy	NF	LD	100	92	15	10.2	9,700	10.2	129	2.6	N	major	1	800	-	-	Em	33	15	94.20%	41.30%	PE	-
123	chinnappan	62	M	1513345	ruptured gall bladder	open cholecystectomy	NF	DE	80	108	15	11.8	23,900	11	122	4.5	N	major	1	400	LP	-	Em	38	16	96.10%	61.30%	Pne	-
124	kathyayini	26	F	1514788	ruptured ectopic	salpingoopherectomy	NF	ND	80	96	15	8.6	8,700	7.2	140	4.2	N	major	1	2,200	HP	-	Em	27	26	96.60%	65.20%	UTI	-
125	thavamani	45	F	1617789	Ca ovary	staging laparotomy	NF	ND	100	82	15	8.8	6,900	7	138	3.6	N	major	1	150	-	DS	Ele	21	13	48.00%	9.70%	-	-
126	baaskar	38	M	1718890	blunt injury abdomen	jejunal resectionesentric repair	NF	ND	74	132	13	7.2	9,800	10	128	6.2	NS	major	3	2,500	BC	-	Em	45	37	100.00%	99.10%	-	septic
127	lalitha	44	F	1615554	choledochal cyst	hepaticojejunostomy	NF	ND	110	84	15	11.4	5,400	7.2	138	5.2	N	major +	1	800	-	-	Ele	17	16	46.30%	9.40%	-	-
128	vincent	33	M	1713356	mesentric cyst	cyst excision	NF	ND	134	76	15	13	6,600	6	139	4.3	N	major	1	100	-	-	Ele	13	9	10.70%	2.00%	-	-
129	kaavan	49	F	1618890	Ca crectum	diversion colostomy	NF	ND	120	68	15	11.4	7,600	6.5	142	3.9	N	major	1	200	-	DS	Ele	15	17	43.00%	8.50%	-	-
130	faritha	52	F	1517978	appendicular perforation	open appendicectomy	NF	ND	110	134	15	10.8	22,800	16	129	5.8	N	major	1	150	LP	-	Em	38	16	96.10%	61.30%	WI	-
131	krishnan	42	M	1516880	urachal cyst	cyst excision	NF	ND	114	82	15	13.5	4,600	7.2	137	3.8	N	major	1	250	-	-	Ele	13	10	12.70%	2.30%	-	-
132	lakshmiammal	62	F	1614456	Ca stomach	palliative gastrojejunostomy	NF	ND	92	64	15	10.4	5,800	8	133	4.5	N	major	1	400	-	DS	Ele	21	17	66.40%	16.90%	At	-
133	parameshwari	44	F	1578990	Ca head of pancreas	palliative triple bypass	NF	ND	106	74	15	9.8	6,700	9.8	128	5.8	N	major	1	550	-	DS	Ele	27	19	88.30%	38.00%	HK	-
134	raman	56	M	1615545	Ca anorectum	diversion colostomy	NF	ND	110	66	15	9.6	7,900	10	129	3.1	N	major	1	800	-	DS	Ele	26	19	86.50%	35.00%	DVT	-
135	jameela	34	F	1617890	pelvic mass	TAH with BSO	NF	ND	110	72	15	10.4	5,900	7	136	4.8	N	major	1	400	-	Prim	Ele	15	11	19.50%	3.50%	-	-
136	sudalai	45	M	1514334	umbilical sinus	sinus tract excision	NF	ND	120	82	15	13	12,900	7.1	133	3.5	N	major	1	150	-	-	Ele	15	10	16.70%	3.00%	-	-
137	veera	42	M	1987760	ileal perforation	primary closure	NF	ND	82	126	15	11.2	18,600	9	149	3.2	N	major	1	350	BC	-	Em	32	20	95.30%	57.90%	WD	-
138	maragatham	82	F	1514467	acute intestinal obstruction	resection anastomosis	Diu	LD	86	122	14	8.8	3,500	10.4	126	6	N	major	1	600	-	DS	Em	55	23	99.90%	97.80%	-	MODS
139	govindhan	36	M	1617789	reperitoneal dermoid	dermoid excision	NF	ND	130	84	15	12.4	4,600	6	134	5.2	N	major	1	300	-	-	Ele	16	10	19.00%	3.40%	-	-
140	sagayam	52	M	1619905	enterogenous cyst	resection anastomosis	NF	ND	140	78	15	13	5,300	6.2	138	4.2	N	major	1	450	-	-	Ele	13	10	12.70%	2.30%	-	-
141	latha	22	F	1134560	multiple jejunal perforation	jejunal resection/ anastomosis	NF	ND	88	118	15	8.6	22,000	11	130	5.5	N	major	1	600	BC	-	Em	41	22	99.20%	85.90%	AL	-
142	raniammal	45	F	1216678	obstructed incisional hernia	ileal resection/ ileostomy	NF	ND	90	114	15	7.2	19,000	11.8	129	6.1	N	major	1	750	-	-	Em	39	16	96.70%	64.30%	Pne	-
143	kumaran	35	M	1271189	penetrating injury abdomen	ileal resection/ ileostomy	NF	ND	84	120	15	10.2	9,800	10	133	3	N	major	1	800	BC	-	Em	30	22	95.60%	59.40%	AKI	-
144	thilagam	78	F	1215578	malignant gastric perforation	omental patch closureJ	NF	DE	70	110	15	9.4	13,900	13	130	5.9	N	major	1	700	BC	DS	Em	43	29	99.80%	96.00%	ARDS	-
145	radhika	42	F	1317790	haemangioma liver	hepatic resection	NF	ND	120	88	15	12	6,500	5	137	4.1	N	major	1	900	-	-	Ele	14	12	19.90%	3.60%	-	-
146	ronisingh	56	M	1516689	choledochoduodenal fistula	cholecystectomy/CBD exploration	NF	ND	130	96	15	13	23,500	6.2	140	3.2	N	major	1	1,200	-	-	Ele	17	16	46.30%	9.40%	WI	-
147	viswanathan	30	M	1510045	parietal wall sinus	sinus tract excision	NF	ND	132	86	15	12.8	5,500	7	138	4.2	N	major	1	100	-	-	Ele	15	9	14.20%	2.50%	-	-
148	chellapan	59	M	1547789	GOO- pyloric stricture	gastrojejunostomy	NF	ND	100	62	15	10.4	7,200	5.3	144	4	N	major	1	300	-	-	Ele	16	10	19.00%	3.40%	-	-
149	uma	62	F	1271167	aortic aneurysm	open repair	NF	ND	80	98	15	9.6	8,200	9	145	5.3	Tin	major +	1	1,300	-	-	Em	37	23	98.80%	81.00%	AKI	-
150	bharathi	65	M	1615589	colonic perforation	primary closure/ileostomy	NF	DE	100	114	15	12.4	22,700	11	142	3	N	major	1	600	BC	-	Em	28	22	94.00%	53.00%	WD	-
151	komalam	79	F	1619904	sigmoid volvulus	sigmoidectomy/end colostomy	NF	ND	144	98	15	9.6	5,600	8	123	6.1	N	major	1	800	-	-	Em	39	15	96.00%	60.60%	UTI	-
152	suguna	42	F	1713356	pelvic abscess	open drainage	NF	ND	120	86	15	10.4	9,800	7	137	4.3	N	major	1	300	LP	-	Em	16	16	42.30%	8.30%	-	-
153	ezhil	22	M	1714489	appendicular abscess	open appendicectomy	NF	ND	110	92	15	11	9,200	6.2	139	4	N	major	1	150	LP	-	Em	16	16	42.30%	8.30%	-	-
154	babujaan	32	M	1714889	ileal perforation	primary closure	NF	ND	90	116	15	10.4	24,500	9	129	5.6	N	major	1	400	BC	-	Em	31	20	94.50%	54.70%	WI	-

KEY :

NF - - No Failure

Dig - - On Digoxin

Diu - - On Diuretic

CCF - - Congestive cardiac failure

ND - - No Dyspnea

DE - - Dyspnea on Exertion

LD - - Limited Dyspnea

DR - - Dyspnea at Rest

Con - - Consolidation

SBP - - Systolic Blood Pressure

PR - - Pulse Rate

GCS - - Glasgow Coma Scale

Hb - - Hemoglobin

TC - - Total Count

Prim - - Primary malignancy

NDS - - Nodal Spread

DS - - Distant Spread

Ele - - Elective

Em - - Emergency

LP - - Local Pus

BC - - Bowel Contents

HP - - Hemoperitoneum

WI - - Wound Infection

WD - - Wound Dehiscence

AL - - Anastomotic leak

SIRS - - Systemic Inflammatory Response Syndrome

MODS - - Multiorgan Dysfunction Syndrome

ABSTRACT

INTRODUCTION

Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity (POSSUM) has been used to produce numerical estimate of expected mortality and morbidity after variety of surgical procedures. It can be used in hospital setting to provide educational information. It integrates well in the existing hospital programs without causing any disruptions of hospital activities.

AIMS & OBJECTIVES

POSSUM is a patient risk prediction model based on 12 patient characteristics and 6 characteristics of the surgery performed.

The objective of the present study is to assess the accuracy of POSSUM in predicting mortality and morbidity in patients undergoing laparotomy in both elective and emergency settings

MATERIALS & METHODS

Sample size of 150 has been calculated. A prospective and descriptive study design was formulated and the study was conducted in govt. Stanley medical college, Chennai. The duration of the study was from 01 Oct 2014 to 30 Aug 2015.

An informed consent was obtained from all patients/their legal guardian. During hospitalisation, appropriate work up as deemed necessary was done. Physiological severity was scored on admission. All patients were operated under general anaesthesia. The operative severity was scored after a period of 30 days.

RESULTS & DISCUSSION

In elective patients, the expected to observed morbidity was similar, but significance couldn't be attributed as the prevalence of morbidity as such was low in that group. Among those who had post surgical complications, their POSSUM score was high, indicating a good specificity of the score.

In the emergency group, the correlation was significant with the predicted morbidity levels being the same as what was actually seen in the study. A graph showing the expected to observed ratio showed that the two lines were parallel and close to each other, indicating a significant level of correlation. Out of the 50 odd patients who had a morbidity predicted percentage of more than seventy, forty two patients developed post surgical complications indicating a high level of sensitivity and specificity for the score to predict morbidity

With regards to mortality, the low rates of mortality in the study precludes any meaningful analysis. Among the five patients who died, their POSSUM predicted mortality percentage was more than ninety in four of the cases and conversely out

of the six patients who had a POSSUM score of more than ninety percent, four patients died. This again indicates a high level of sensitivity and specificity of the score to predict mortality.

Chi Square analysis of the significance of POSSUM score to predict morbidity and mortality among our study group patient showed a high level of significance <0.001 for both mortality and morbidity.

CONCLUSION

POSSUM morbidity equation can reasonably predict morbidity in high risk groups whereas the sensitivity falls in elective conditions.

POSSUM mortality equation over predicts mortality especially in low risk groups, while the predictive value improves significantly when exponential analysis is used.

Hence POSSUM scoring system has an undeniable advantage in our set up for better patient counseling, improving the surgical outcomes in both emergency and elective wards and for better management of limited resources and manpower.